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TABLES FOR THE DETERMINATION OF MINERALS

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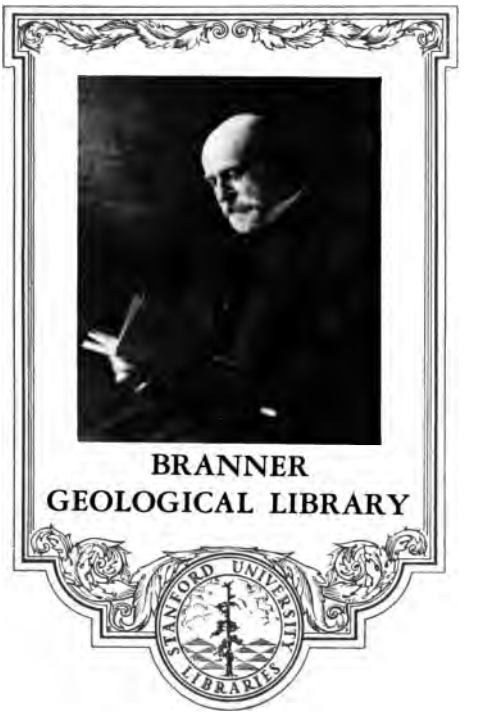
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TABLES

FOR THE

DETERMINATION OF MINERALS

BY

PHYSICAL PROPERTIES

ASCERTAINABLE WITH THE AID OF A FEW FIELD INSTRUMENTS

BASED ON THE SYSTEM OF PROF. Dr. ALBIN WEISBACH

BY

PERSIFOR FRAZER

DOCTEUR ÈS-SCIENCES NATURELLES; OFFICIER DE L'INSTRUCTION PUBLIQUE, FRANCE; PROFESSOR OF CHEMISTRY PENNSYLVANIA HORTICULTURAL SOCIETY; CORRESPONDENT DER REICHSANSTALT ZU WIEN; VICE-PRESIDENT FOURTH INTERNATIONAL GEOLOGICAL CONGRESS; HONORARY MEMBER SOCIEDAD CIENTIFICA "ANTONIO ALZATE," MEXICO; ONE OF THE SECRETARIES OF THE AMERICAN PHILOSOPHICAL SOCIETY; LIFE MEMBER AM. INST. M. E., ACAD. OF NAT. SCI., B.A.A.S.; LIFE FELLOW A.A.A.S., G.S.A., ETC., ETC.

FOURTH EDITION TO WHICH ONE HUNDRED AND THIRTY-FIVE ADDITIONAL SPECIES HAVE BEEN ADDED

PHILADELPHIA

J. B. LIPPINCOTT COMPANY

1897

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WHILE conducting the exercise of mineral determination in the Freiberg Academy here, I have noticed that the students, in examining the specimens given to them, often lose much time in looking out and reading the descriptions in the various compendiums of minerals; and this originated in me the desire to place in the hands of those taking this course a means to assist in the diagnosing of minerals; all the more from the fact that the only attempt thus far known, and which was by Dufrenoy,* to help the determination of minerals by their physical characteristics, can scarcely be said to have been a success. On the other hand, in the tables of von Kobell† and Dana,‡ the chemical behavior has been selected as the main principle of classification, the employment of which, it is true, in itself and for a single student, is very good, nevertheless in a larger class associates with itself many disadvantages when the students are not sufficiently conversant with the physiognomy of minerals.

From this cause I determined to sketch out a plan of arrangement for myself, in the main based upon the outward characteristics.

In this I have divided minerals into three tabular systems, of which the first embraces those of metallic lustre; the second those of non-metallic lustre which give a colored powder; and lastly, the third contains all minerals of non-metallic lustre and colorless streak. These three systems of tables fall again into single tables (for example, the first into five), in which the minerals are arranged according to their hardness,—*i.e.*, the softest are placed first, and the hardest last.

It follows from this, that when a given fragment of mineral is to be determined by the aid of the tables, one must first ascertain the kind of lustre, the degree of hardness, the streak, and (with metallic habit) also the color. If these characteristics are determined correctly,—and their determination is so easy,—the seeker will be confined by the tables to a small number from which the choice must be made; out of which the correct one can be found sometimes immediately, and sometimes with the assistance of a special search in a text-book of mineralogy; but almost always without difficulty, provided that the crystal system be plainly visible; if this characteristic be wanting, the determination will be more difficult, or at least more tedious, especially when the mineral belongs to the class of those with non-metallic lustre and colorless streak.

ALBIN WEISBACH, *Preface to the First Edition of his "Tabellen,"* 1866.

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* Dufrenoy, Traité de Minéralogie, 2e édit., i. 529–703.

† F. v. Kobell, Tafeln zur Bestimmung der Mineralien mittelst einfacher chemischer Versuche auf trockenem und nassem Wege.

‡ J. D. Dana, A System of Mineralogy, 4th edit., i. 261–310.

INTRODUCTION TO THE FIRST EDITION.

(1874.)

* * * * * * * * * * *

EVERY one who has had the good fortune to study at the Royal Saxon Mining Academy, in Freiberg, will bear witness to the efficacy of the system there pursued for instructing young students in the art of distinguishing mineral species on the spot, by the aid of a tolerable memory and an intelligent observation of a few of their most striking physical properties,—both brought to the highest point of perfection of which they are capable by judicious cultivation, and kept in their best condition by assiduous daily exercise.

The method of practical instruction pursued there, and which has been introduced by Freiberg graduates into many schools in this country, requires merely a cabinet of unlabelled minerals, and a Professor who can determine—not one who has *learned*—them. Each student of a class of ten or more places a tray of such minerals before him, and occupies the two hours devoted to "Praktischer Uebung" in discovering, by the aid of the knife, the streak-tablet, the file, and the magnifying-glass, the true nature of as many of these minerals as possible.

* * * * * * * * * * *

But all will admit that no tables based upon purely physical properties can enable one to identify *all* species; though the greater one's experience in the field, the fewer minerals will require a laboratory investigation.

There are three applications for which these tables were more particularly designed: The first is in the class-room, as an artificial memory to the student practising instantaneous determination; the second is for the prospector, geologist, or mineralogist in the field, as an occasional reminder of some point which was escaping his attention, and to suggest the simplest methods of discovering the identity of minerals if the physical tests fail; and third, they may prove serviceable to him who, though neither geologist nor mineralogist, is impelled by business or love of nature to collect minerals.

In America mineralogists have very generally agreed to consider Dana's last edition as authority on most disputed questions, and in nothing does this great work more clearly show the incredible industry, care, and good judgment of its author than in the considerations which have influenced him in regard to the choice of names for minerals. He has given to this essential though less professional part of the subject so much thought, has weighed so fairly and justly the claims of rival claimants to the right of naming, and has altered objectionable names with such independence and ability, that it would be strange indeed if an American book on any branch of the subject did not make Dana's nomenclature the basis of its own. This has been done in the present tables.

Every true mineral is a definite chemical compound, or element, homogeneous throughout its parts, and capable of expression in a formula which represents—at least—the proportions in which the atoms of the same or different elements are associated together in its molecule.

Its molecule is a distinctive whole,—the unit of its mass,—and incapable of division so long as the mineral retains its characteristic properties; and any formula which repre-

sents the mineral as consisting of two compounds is in antagonism with this fundamental principle, and can convey no clear idea of unity to the mind.

Starting with these postulates, as soon as I had decided to add a column of formulas to the tables, I determined to try, to the best of my ability, to reconcile the most reliable records of analysis with it, and if possible, in the light of the modern chemistry, to push this effort beyond mere empirical percentages to the construction of rational formulas. I frankly own at the outset my entire responsibility for all the errors into which I may have been drawn, and cheerfully grant that many of my inferences may be mistaken.

While overhauling the records of analysis which were accessible to me, to recalculate formulas whose character should express unity, I was forced in some few cases into making bold assumptions as to the manner in which the anion and cathion radicals were strung together, and it is in such formulas that I expect, and shall meekly submit to, criticism.

In the case of some silicates, * * * I have assumed that the total power of the aluminum atoms to satisfy acid radicals is diminished by so many bonds as are represented by the number of atoms of the other cathion elements present, these bonds uniting the latter as to an acid, and leaving the remainder to be in turn saturated by the acid silicon radical. I confess that this hypothesis does some violence to old accepted notions of chemical union, more particularly as the dyad thus saturating the aluminum must always itself be a stronger cathion than the latter, and therefore more likely to combine with SiO_4. These difficulties are plain, and I can only say that this arrangement agrees with the percentage composition of the minerals as derived from some of the most trustworthy records of analysis, and that I discovered no other which would.

It is necessary for this hypothesis to assume that no aluminum molecule is *completely* saturated with the base, and that none of this base is united directly to $(SiO_4)^{IV}$, for in either case there would be a splitting up of the original molecule into two others.

It is understood, of course, that what I have said as to the exclusion of the sign + from the formulas of minerals has no reference to the molecules of water, which always accompany crystallization in certain minerals; nor have I deemed it necessary to indicate this water by the symbol aq., for the reason that +6aq., or +12aq., seems inconsistent with a pure chemical notation.

Simply for convenience, and as an arbitrary method of indicating the parts I have supposed its constituents to be playing in the compound, I have adopted the plan of writing the symbol for the other bases before that of Al_2 *without* a comma when the whole of its combining power is added to that of the latter to saturate the anion radical, and *with* a comma between them when the number of atom-saturating equivalents of the bases was constant, while the proportion to each other of the bases was variable. As, for example: $(R^{II}(R_2)^{VI})(Si^{IV}O_3^{II})_4^{II}+6(H_2O)$ * * * means that an atom of a dyad base and a molecule of hexad base together satisfy four molecules of the bibasic radical, $(Si^{IV}O_3^{II})^{II}$; whereas $(R_3^{II},(R_2)^{VI})(Si^{IV}O_3^{II})_3^{II}$ implies a compound in which the six bonds of $(Si^{IV}O_3^{II})_3^{II}$ are divided in varying proportions between the dyad and hexad base; and $((R_2)^{VI}R^{II})^{IV}(Si^{IV}O_3^{II})_2^{II}$ is meant to formulate a compound in which the dyad R^{II} partially saturates $(R_2)^{VI}$, leaving it but four bonds out of six.

There are minerals scattered through the tables which defied all efforts of mine to bring them into the general fold of those possessing unity of formula, and these have been written simply empirically or with the *relative* number of atoms which their analysis showed, without any attempt to make a formula.

PREFACE TO THE SECOND EDITION.

(1877.)

* * * * * * * * * * *

MINERALS without which the smallest collections would not be complete are printed without any mark. Those which, while common enough in collections of some size, might be absent from the very smallest, are furnished with a dagger (†). Minerals which are found only in the largest or finest collections are marked with a double dagger (‡).

* * * * * * * * * * *

It is with great satisfaction that I note in the lately-issued "Text-Book of Mineralogy by Mr. E. S. Dana, on the plan and with the co-operation of Professor James D. Dana" (New York, Wiley, 1877), that the principle which must govern the construction of mineral formulas,—*i.e.*, the unity of the mineral molecule,—and which I so strongly emphasized in the preface to the first edition, finds abundant recognition throughout. Not indeed everywhere, and not in the form of rational, but generally in that of empirical formulas: yet this latter form of stating the constituents of a mineral seems vastly preferable to that of separate compounds united by the sign plus (+). It cannot be doubted, either, that until we are more advanced in our knowledge of the conditions affecting the existence of the gaseous, the liquid, and more especially the solid molecule, the safest method of writing a mineral formula is the empirical. But who would shut his eyes to the lines of order which rational formulas point out, imperfect though they be?

* * * * * * * * * * *

A table of elements, with their atomic weights and valences, according to the most recent investigators, forms a new feature in this book. By its aid the percentage composition of any mineral in the tables may be calculated in the absence of handbooks containing the records of actual analyses.

PREFACE TO THE THIRD EDITION.

(1891.)

THE first edition of this work was meant to be an English translation, with improvements earning for it the right to be considered a new edition, of the "Tabellen zur Bestimmung der Mineralien," by Professor Dr. Albin Weisbach; but before it was fairly commenced I saw that it would have to be modified in many particulars in order to meet the wants of American readers. The changes and additions were so numerous as to make virtually a new book, in which, however, the general plan sketched by Dr. Weisbach was followed. The Freiberg school in the hands of Werner and Breithaupt was essentially the physical school of mineralogy, great attention being paid to outward characteristics, and especially to crystal system and form. Its pre-eminence in these things was in no wise lost under Professor Dr. Weisbach; but the increase to our knowledge of minerals, both dependently and independently of chemical theory, has been so enormous; the points from which to view them, the methods applied to their determination, and the special workers have become so numerous, that Freiberg is no longer, as it was for many years, without a rival in the teaching of mineralogy. In crystallography her word is no longer final, while in the chemical philosophy and classification of minerals Freiberg has been fairly outstripped. Even at the time of the publication of the first edition of these tables no account was taken in Freiberg of the great progress in the science of chemistry, but the formulas of minerals were written in the style of the unfortunate reaction from the lucid views of Berzelius, with the symbol for the water molecule HO. This was why the present writer felt it important to calculate the chemical formulas of minerals in the first edition of this work according to the light of the "new"—really the old—chemical theory, and he believes that it was the first time that this had been done in this country.

It will appear, from the fragment of the preface to the first edition which is retained, that he did not presume that this effort would be successful in all cases; but, considering the fact that perhaps as much has been learned of minerals and of chemical theory relating to them since 1874 as had been acquired up to that date; and considering also the fact that in seeking for rational formulas out of a mass of analyses by different chemists, without the opportunity of practically testing his assumptions, he was groping in the dark, it is very gratifying to him to observe, that the most modern formulas by the masters of greatest authority agree in a large number of cases accurately with those presented in this book at that time. Still a greater number differ from his tentative formulas of 1874 only because of the additional and more accurate data concerning the respective minerals obtained since that date. He is also happy to note that the principle for which he then contended, of the unity of the mineral molecule, in opposition to the theory of Professor J. D. Dana, has been tacitly conceded by all modern writers, including Professor Dana himself.

In rewriting the tables from beginning to end at the present time it was clearly unnecessary to repeat the preliminary work in mineral formulas, which the writer had undertaken at a great disadvantage, because no authoritative references were to be had.

With a work at hand so universally accepted as that of Dr. P. Groth's "Tabellarische Uebersicht der Mineralien" the old formulas of the former edition of this work became superfluous, and were—it is true, somewhat regretfully—displaced to make room

for their betters. Dr. Groth has been made the standard authority on crystal system and chemical formula throughout this work, though in the latter the order in which he has placed the elements in his formulas has been frequently changed to conform with the practice adopted in the earlier edition of placing the cations as much as possible first and the anions last.

On the other hand, Professor Weisbach's new edition of his tables (Leipzig, 1886), to which he has added a column for chemical formula, much needed in his earlier work, has been followed closely in descriptions of superficial appearance and in the valuable table of paragenesis.

The Freiberg school is still at the head of all others in the matter of systematic and exhaustive description of the appearance of the surface of minerals to the eye, of their fracture in small and large masses, and of their habit, structure, texture, and form as distinguished from their crystallization. In color, streak, hardness, tenacity, cleavage, and fracture, where the authorities differ, Professor Weisbach has been taken as the standard.

A new departure has been made in some of the terms used in describing a mineral, not without considerable reflection. The English vocabulary of mineralogy lacks many words of great utility in describing minerals. "Eingesprengt" has been rendered in other books "disseminated," or "diffused," but these words do not convey the picture to the mind of what is meant as well as "interspersed," which has been adopted in this work. "Muschlig," "schalig," and "schuppig" are rendered "conchoidal," "*shelly*," and "scaly" in the following pages. "Säulig" and "stänglig" are given as "columnar" and "stalky." The latter word is somewhat barbarous, but is believed to convey the idea as well as "stem-like," besides being shorter.

One who contends for elegant diction may be shocked to see Erythrite described as "warty," but the figure is graphic if homely. The greatest difficulty in choosing terms as equivalents was experienced when "broad stalky," "short stalky," "fine reniform," etc., were required. There was no help for it, however, short of periphrasis, which would have added to the size of the book without other advantage than euphony, and this, whether or not wisely, was thought an insufficient one.

The table of elements at the end of the book is that of Professor F. W. Clarke, chief chemist of the United States Geological Survey, calculated for the committee of revision and publication of the Pharmacopœia of the United States, adopted by that body, and recommended to American chemists universally in order that their results may be comparable. Professor Clarke is one of the highest American authorities on the subject of the atomic weights, and has in late years done much work in this direction. He has adopted oxygen as 16 for a base, and calculated the other atomic weights, both above it and below it, to correspond with this number. This has the advantage of giving a whole number to the element which enters more largely than any other into chemical calculations and reducing the error of those determinations where hydrogen must be multiplied as unity by large factors on the erroneous supposition that its relation to oxygen is as 1 : 16. It has the further merit that many of the atomic weights which, through scorn of Prout's supposed law, certain chemists have been writing with two decimals, come out so near whole numbers that they may be considered so. Professor Clarke's numbers, which are the result of diligent and intelligent labor, may be considered as a scientific plea in extenuation of Prout. But the main advantage of the adoption of this table is uniformity of language among chemists, an advantage of the metric system of weights and measures unhappily so long neglected. With a common table of constants the necessary corrections and emendations can be made simultaneously and without discordance, whereas with the present confusion of tables the real significance of an important correction of an atomic weight is often lost sight of. The writer's own experience in attempting to compile an accurate table of elements is a proof of this. Starting out with the table of Professor von Meyer, he wrote to some of the most eminent chemists here and abroad. The corrections to any given table were as numerous as the authorities he invoked. It was evident that numbers had been accepted without in all cases scrutinizing the data on which they were based, so that in any one table two or three discordant assumptions might be concealed.

The historical part of the tables is taken from a printed sheet prepared thirteen *years ago* by the writer for his chemical class in the Franklin Institute.

Following the excellent plan of Weisbach's new table, notes as to the habit and structure of minerals have been added in the old column of "Crystal System," after the letters *H.* and *S.* respectively. The fracture has been appended to Cleavage, after the letters *Fr.* Under the column of "Remarks" are given the specific gravities ("G."), the chemical tests, etc., and the minerals associated with the species described ("*A.*").

I have omitted altogether the supplementary tables to assist in the determination of those minerals of non-metallic lustre and colorless streak which cannot be determined by the aid of simple instruments and a close observation of their physical characters, and placed the most important pyrognostic characteristics and physical and chemical tests of each mineral in the column of "Remarks." The reason for this change is that when a mineral fragment cannot be identified by such physical tests as are considered in this little book it is better to have recourse to a treatise on blowpipe or general qualitative analysis.

The distinctions which were made in the last edition between common, rare, and very rare minerals by printing the dagger or double dagger after the name of a species, have been in the main retained, but less attention to these marks has been given in the new species which have been added. In fact, nothing connected with minerals is so likely to change as their relative abundance. The discovery of a locality in which certain hitherto rare minerals are found in quantity will in a very short time flood the mineral market with them, so that it is hardly worth while to attempt a rating of their frequency of occurrence except in a periodical where constant revision is possible.

The synonyms of minerals have been more largely given than in the previous work, and in some cases, such as garnet, sub-varieties have been added after the synonyms without much notice of the distinction between the two. It is not thought, however, that this will cause any confusion, and the distinction is not always easy to make.

Abbreviations have been freely used, especially in the columns of "Crystal System" and in pyrognostic characters: as, hxhdl. for hexahedral, dodecl. (dodecahedral), r'dl. (rhombohedral), masv. (massive), retic. (reticulated), *ch* (on charcoal), etc. These abbreviations will be readily understood by all who have had preliminary instruction in mineralogy.

In conclusion, I wish to acknowledge my indebtedness for suggestions to Mr. C. Bement, Professor H. B. Cornwall, Professor Wolcott Gibbs, William Crookes, F.R.S., P.P.C.S., and very especially to Professor F. W. Clarke.

PHILADELPHIA, 1891.

PREFACE TO THE FOURTH EDITION.

(1896.)

A FOURTH edition has been rendered desirable by the growth of the science, which is proceeding with ever-increasing rapidity. The changes are more largely additions than alterations, and comprise about one hundred and thirty-five species and sub-species, interpolated among the seven hundred and sixty odd species, sub-species, and synonyms contained in the third edition. These have been selected as the result of a year's deliberation, and in accordance with the views of a few American mineralogists in whose judgment I place great confidence; yet it has not been done lightly. There is always the danger of transforming a useful guide into a cumbersome book, which loses the advantages of portability and the saving of time, while it cannot possibly compete with the exhaustive books of reference. Such an exhaustive source of information is the last edition of Dana's "System of Mineralogy," superior to any similar book ever published as a compendium of all the information attainable to date. For the reason that it is the American authority, and one of the very highest of all authorities on mineralogy, I have always conformed to its data where this Weisbach scheme of tables permitted (see prefaces to previous editions), while in the important feature of chemical formulas I have had the satisfaction of seeing Dana's great work adopt the principle which I embodied in the first Weisbach tables printed in English.

In the present edition the physical and pyrognostic characters of the added species have been given as nearly as possible in the terms of Dana's System, and in one or two cases the chemical and crystallographic data also, which otherwise have been based upon the work of Groth.

It is hoped that the method of introducing the added matter into the volume will be found to possess some other merit than that of economy in the use of the old electrotype plates. The names of the added species are introduced in smaller type where the full description would be if the book were to be reset; and where the student, prospector, or naturalist has traced the mineral he is examining to a small group in which occur one or more of these names without description, he is referred to the Supplement at the end of the book, where the minerals are arranged in alphabetical order without reference to their affinities or relationships.

The method of determining the nature and name of a mineral by applying to it successive physical tests, each of which excludes more and more species until that which is sought is reduced to one of two or three, or successfully isolated, cannot be pursued directly with the Supplement alone, because the minerals here are not classified. It will be necessary to search in the main body of the work for the characters most nearly resembling those of the object examined; and it is advised in all cases to look at the descriptions of two or more species adjacent to that whose characteristics most nearly correspond with those of the mineral to be determined.

More use than formerly has been made of the numbers in the scale of fusibility. Such numbers, except when it is otherwise specified, refer to von Kobell's scale, given on page 156.

The index has not only been enlarged to include the names of species which do not occur in the third edition, and of those sub-species and synonyms of the last edition *which were not included in its* index, but it has been entirely recast so as to include every

name of a mineral or rock mentioned in any column. The advantage of this is that one can find by referring to the index the various rock matrixes and the minerals which are found embedded or interspersed in them.

To those who have read the title-pages and prefaces of the first three editions of this work, issued at intervals during a period of seventeen years, or from 1874 to 1891, it will be unnecessary to say that I have never claimed any part of the invention of the system on which they are based. This excellent plan, which seeks to systematize the methods by which a mineralogist reasons from the observed characters of the mineral under investigation to its actual name and constitution, and to supply his experience and skill to those less proficient by means of well-ordered tables, is exclusively the conception of Oberbergrath Professor Doktor Albin Weisbach, and has been so acknowledged in every issue. In my preface to the first edition of this work, dated 1874, was printed the following extract from a letter of Professor Weisbach to me:

"* * * Regarding the proposed translation by you of my mineral tables, I give you willingly my approval and permission. It is true that many things in them are antiquated." In the same preface it was stated, "My aim throughout has been to follow the original design of Professor Weisbach as closely as circumstances would permit; but certain changes were unavoidable in presenting the work to the American public, and I have not hesitated to make them. These changes are partly of the nature of alterations of some of the minor details of his method, and partly of the nature of additions or alterations to his original scheme. By referring to the author's preface* and comparing his remarks with the present work, it will be observed that many of them are inapplicable to it."

The changes are then enumerated, such as the adoption of Dana's names; Dana's or Naumann's determination of kinds and degrees of lustre; Dana's crystallographic symbols; the omission of Weisbach's sign for minerals whose crystal system had been deduced from their optical properties; the omission of signs signifying that the minerals were not found in Germany, and that they were rare; the omission altogether of many minerals given by Weisbach and the introduction of others not given by him; the addition of the specific gravity of every mineral; and, greatest of all, the addition of the chemical formula and some blow-pipe or other easily-determined reactions on the same page.

These modifications of Professor Weisbach's original tables have grown more numerous in every succeeding edition of the English "Tables," so that there is less resemblance between my third edition, printed in 1891, and the third edition of Professor Weisbach's Tables, printed in 1886; and still less between the present fourth edition and Weisbach's fourth edition of 1892, which I had not seen until this was electrotyped. But the system of classification, the utilization of lustre, color, streak, hardness, physiological properties, etc.,—in fact, the entire framework of the structure,—is solely and entirely the creation of my former professor; and if the changes I have made in the filling in of the framework have not been judicious, at least I have assumed the entire responsibility for them and relieved him of all reproach for their introduction. In one important particular, viz., the addition of the chemical formula to the description of each mineral, Professor Weisbach has indicated his approbation of the change by adopting it in the editions of his own work published subsequently to my edition of 1874. That he has not found fault with me for diverging so far from his own text, I have the right to infer from the fact that he has never so informed me, though we have several times met and corresponded during the last twenty years; and also because he has done me the honor to divide with me the only pecuniary recompense—an extremely small one —I have ever received from the publishers of this book; which I offered him, without any obligation or understanding to do so, on account of the uniformly pleasant relations between my former professor, the originator of the plan of these tables, and his one-time pupil, their adapter to the American public.

November, 1896. P. F.

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* Professor Weisbach's preface of 1866, which was given entire in the first edition of this book.

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FOR THE

DETERMINATION OF MINERALS.

I. MINERALS O

NAME.	COLOR.	STREAK.	HARD'SS.	TENACITY.
Copper	copper-red	copper-red	2.75	malleable
Bornite (Buntkupferkies, Erubescite)	between copper-red and bronze-yellow	black	3.50	sect. to bri
Niccolite (Nickelin, Arsennicke., Rothnickelkies)	light copper-red	brownish black	5.25	brittle
Breithauptite† (Antimonnickel)	copper-red violet hue	red-brown	5.5	brittle

TALLIC LUSTRE.

L SYSTEM, IT, AND ICTURE.	CLEAVAGE AND FRACTURE.	CHEMICAL FORMULA.	REMARKS. Sp. Gr., Reactions. *A* = Associated Minerals.
il., dodcl. v., inter- l, coat- ı sheets, ır, wiry.	*Fr.* hackly	Cu (oc. with Ag, As, Sb, Bi, etc.)	G. 8.9. BB *ch.* easily fusible, on cooling covered with black oxide. Sol. in nitr. ac., giving red fumes and penetrating odor; deep blue on addition of ammonia. *A.* In beds and veins usually near igneous rocks.
l., dodcl. v., inter- l.	.....	Cu_2FeS_2	G. ± 5.0. Copper-colored fresh fracture. BB fuses to brittle magnetic globule. Sol. in nitr. ac., with separation of sulphur. *A.* Chalcopyrite, Malachite, Chalcocite.
use pyr. v., inter- l.	.....	NiAs (oc. with Fe, Co, Sb, and S)	G. 7.5. Crystals rare. BB *ch.* arsenic fumes. Fuses to button. *A.* Chloanthite, Smaltite, Bismuth, Silver, Arsenic, Barite, Fluorite.
ı tab. ırsp.	.....	NiSb (oc. with galena and tr. Fe)	G. 7.5. Weathers reddish blue. BB like Niccolite, but with reaction for Sb in place of As. *A.* Chloanthite, Galenite, Blende, Calcite.

NAME.	COLOR.	STREAK.	HARD'SS.	TENACITY.
Sternbergite‡ (Silberkies, in part)	pinchbeck-brown bronze-yellow	black	1.5	sectile
Gold	gold-yellow	gold-yellow	2.5	malleable
Electrum‡	yellowish white	yellowish white	2.5	malleable
Calaverite†				
Bornite† (Buntkupfer-kies, Erubescite)	reddish pinchbeck-brown	greenish black	3.5	brittle
Millerite† (Gelbnickelkies, Haarkies)	speiss to bronze-yellow	black to bright	4	brittle
Chalcopyrite (Kupferkies, Copper Pyrites)	brass-yellow	green black	4	sect. to brit

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L SYSTEM, T, AND CTURE.	CLEAVAGE AND FRACTURE.	CHEMICAL FORMULA.	REMARKS. Sp. Gr., Reactions. A = Associated Minerals.
ly. sive.	*Cl.* 0. *Fr.* short fibrous.	$AgFe_2S_3$	G. 4.2. Generally brightly tarnished. BB fuses to magnetic button, on the surface of which separated metallic silver shows. Sol. in aqua regia, with separation of sulphur and AgCl. *A.* Pyrargyrite, Stephanite, Proustite, Arsenic, Barite.
ll., , dodecl. rspersed, lamellar, ;.	.....	Au (usually with Ag)	G. 15.6–19.5. Crystals often deformed. BB fuses easily to gold-yellow button. Not sol. in any single acid. *A.* Pyrite, Galenite, Blende, Arsenopyrite, Antimonite, Quartz.
dl., rspersed, lamellar, ;.	.....	$xAu + yAg$	G. 12.5–15.5. BB, etc., see Gold and Silver. *A.* Pyrite.
ıdl., . v., interd.	*Cl.* 0	Cu_2FeS_3	G. 5. Fresh surfaces after few hours tarnishing red, after longer time bluish red, reddish blue, and blue. (See I. 1.)
l., capil., v., interl.	*Cl.* R perf. *Fr.* fibrous.	NiS (tr. Fe and Cu)	G. 5. Usually in capillary crystals or radiating tufts. BB in open tube SO_2. Fuses to a magnetic button. *A.* Chloanthite, Gersdorffite, Siderite, Barite, Fluorite.
;. r., sphe- . v., interl, reni-	*Cl.* 0 indistinct. 2–i oc. indistinct.	$(Cu_2)S_2(Fe_2)S_2$	G. 4.2. In matrass decrepitates and yields sulphur. In nitr. ac. green solution, with separation of sulphur. Solution becomes blue on addition of ammonia. *A.* Malachite, Bornite, Tetrahedrite, Galenite, Blende, Pyrite, etc.

NAME.	COLOR.	STREAK.	HARD'SS.	TENACITY.
Pyrrhotite (Magnetkies, Pyrrhotin)	bronze-yellow	black	4.5	brittle
Marcasite† (Speerkies, Kammkies)	white speiss-yellow	black	6	brittle
Pyrite (Mundic Schwefelkies, Eisenkies, Iron Pyrites)	pale brass-yellow	black	6.5	brittle

Mercury†	tin-white	.....	liquid	.....
Sylvanite	tin-white	.....	.....	.....
Bismuth†	silver-white with reddish hue	gray	2.25	sect. to britt
Tellurium†	tin-white	gray	2.5	brittle to sec

CRYSTAL SYSTEM, HABIT, AND STRUCTURE.	CLEAVAGE AND FRACTURE.	CHEMICAL FORMULA.	REMARKS. Sp. Gr., Reactions. A = Associated Minerals.
Hex. *H.* tab. *S.* masv., interspersed.	*Cl.* 0 perf. I less so.	$Fe_{11}S_{12}$	G. 4.5. In great part magnetic, frequently containing Ni. Crystals rare. BB fuses to black magnetic mass. O.F. red. *A.* Pyrite, Chalcopyrite, Galenite, etc., etc.
O'rhm. *H.* tab., colmn., pyrdl. *S.* reniform, massive.	*Cl.* I rather perfect. *Fr.* fibrous, fine-gr., compact.	FeS_2	G. 4.7. BB, etc., like Pyrite. *A.* Pyrite, Blende, Galenite, Arsenopyrite.
Isom. *H.* hxhdl., dodecl., octdl. *S.* reniform, lumpy, masv., interspersed.	*Cl.* 0 more or less distinct. *Fr.* fine-gr., compact, fibr.	FeS_2	G. 5. In closed tube, subl. of sulphur and magnetic residue. *A.* Galenite, Blende, Arsenopyrite, Magnetite, Specularite, Siderite, etc.

White.

Isom. (in artificial crystals)	.....	Hg (often with a little Ag)	G. 13.5. BB volatile and condensing in drops.
.....	.....	.....	(See p. 12.)
Hex. *H.* r'dl. *S.* interspersed, massive.	*Cl.* 0 perf. 2,–2 less so.	Bi	G. 9.7. Often brightly tarnished. Crystals very rare. Melts in candle flame. BB fuses, volatilizes. Crystallizes on cooling. *A.* Smaltite, Chloanthite, Barite, Cassiterite, Wolframite, Molybdenite.
Hex. *H.* r'dl., short acic. *S.* masv., interspersed.	*Cl.* I perf. *Fr.* fine-grained.	Te	G. 6.2. Melts in candle flame. BB fuses, volatilizes, gives green tinge to flame, and white coat. *A.* Gold, Sylvanite.

NAME.	COLOR.	STREAK.	HARD'SS.	TENACITY.
Hessite‡ (Tellursilber, Tellursilberglanz)	lead-gray to steel-gray	gray	2.5	malleable
Silver	silver-white	silver-white	3	malleable
Amalgam† (Arquerite, Kongsbergite)	silver-white	gray	3	brittle
Antimony†	tin-white	gray	3	sect. to britt.
Altaite‡ (Tellurblei)	tin-white to yellow-white	gray	3.25	sectile
Domeykite‡ (Arsenkupfer)	tin-white to steel-gray	gray	3.25	brittle
Allemontite				
Dyscrasite‡ (Antimonsilber)	silver-white	gray	3.5	sectile

CRYSTAL SYSTEM, HABIT, AND STRUCTURE.	CLEAVAGE AND FRACTURE.	CHEMICAL FORMULA.	REMARKS. Sp. Gr., Reactions. *A* = Associated Minerals.
Isom. *S.* massive.	*Cl.* indistinct. *Fr.* fine-grained.	Ag_2Te	G. 8.5. (Var. Petzite, iron-black,—brittle. G=9,—contains Gold.) Melts in candle flame. Tarnishes black. BB R.F. fuses and, cooling, shows white, dendritic silver. *A.* Native Gold.
Isom. *H.* hxhdl., octdl. *S.* masv., interspersed, hackly, capil., lamel., coating, retic.	.....	Ag	G. 10.5. Often tarnished yellow, brown, or black. Crystals often deformed. BB fuses easily to white button. O.F. faint red coating of oxide. Crystallizes on cooling. Sol. in HNO_3, precip. by HCl. *A.* Argentite, Pyrargyrite, Proustite, Barite, Quartz.
Isom. *H.* dodecl. *S.* masv., interspersed, coat'g.	.....	(Ag,Hg)	G. 10.5–14. BB mercury volatile, silver left. (See preceding.) *A.* Cinnabar.
Hex. *H.* r'dl. *S.* interspersed, massive.	*Cl.* 0 perf. R and — ½ R distinct. *Fr.* granular.	Sb	G. 6.6. Crystals very rare and small. Melts in candle flame. BB fuses, giving white coat. When heat ceases the button continues to glow, giving white fumes and crusting over with oxide. The white coat colors the R.F. bluish green. Crystallizes from fusion. *A.* Antimonite, Kermesite, Smaltite.
Isom. *H.* hxdl. *S.* massive.	*Cl.* hxdl., distinct	PbTe	G. 8.1. Lustre very brilliant. BB entirely volatile. Fuses to button, coloring flame bluish, and giving coal lustrous metallic coating. *A.* Hessite.
(?) *S.* masv., interspersed.	*Fr.* uneven	Cu_3As	G. 7.5. BB arsenic fumes and malleable button of copper. Sol. in HNO_3 but not in HCl. Algodonite (Cu_6As) and Whitneyite (Cu_9As) are allied species.
O'rhm. *H.* colmn., tab., obtuse pyr. *S.* masv., interspersed.	*Cl.* 0 distinct. *Fr.* gran., uneven.	Ag_2Sb (?)	G. 9.5. Often tarnishes dark gray. Melts in candle flame. BB fuses to button, coating coal with white antim. ox. and leaving pure silver. *A.* Galenite, Arsenic, Pyrargyrite, Silver, Smaltite.

NAME.	COLOR.	STREAK.	HARD'SS.	TENACITY.
Löllingite (Arsenikalkies, Pharmakopyrite)	tin-white	grayish black	5	brittle
Smaltite (Chloantite, Weissnickelkies)	tin-white	gray	5	brittle
Gersdorffite† (Graunickelkies, Arsennickelkies)	tin-white to blue-gray	lead-gray to tin-white	5	brittle
Glaucodote				
Linnæite† (Kobaltkies)	red silver-white	grayish black	5.25	brittle
Cobaltite (Kobaltglanz, Kobaltin)	red silver-white	grayish black	5.5	brittle
Arsenopyrite (Mispickel, Arsenkies)	tin-white	grayish black	5.5	brittle
Ullmannite‡ (Antimonnickelkies)	tin-white	black	5.5	brittle

TAL SYSTEM, ABIT, AND RUCTURE.	CLEAVAGE AND FRACTURE.	CHEMICAL FORMULA.	REMARKS. Sp. Gr., Reactions. A = Associated Minerals.
m. cic. asv., inter-sed.	*Fr.* compact, fine gran., stalky, fibrous.	$FeAs_2$	G. 6.8. Crystals rare. Closed tube, subl. of As. BB odor of As and magnet. button. *A.* Galenite, Blende, Pyrite, Magnetite, Cassiterite, Siderite.
1. ıxdl. asv., inter-sed, reticu-l.	*Fr.* compact, short fibrous, fine gran.	$(Co,Fe,Ni,)As_2$	G. 6.8. Often with apple-green coating. In closed tube As. BB arsenical odor, and fuses to button containing Fe,Co,Ni. *A.* Niccolite, Bismuth, Proustite, Barite, Fluorite, Siderite.
1. ctdl. assive.	*Cl.* cub. (rather perf.)	$Ni_{(Fe)}AsS$	G. 6. In closed tube decrep. and deposits sulphide of arsenic. Decomp. by HNO_3, with formation of green sol. and separation of S and As_2O_3. *A.* Niccolite, Siderite.
1. ctdl. drl.	.....	$(Ni,Co,Fe,)_3S_4$	G. ± 4.9. BB As and S odor. Fuses to magnetic button. Sol. in HNO_3 with separation of S. *A.* Chalcopyrite, Tetrahedrite, Siderite.
1. xdl., octdl., cl., ihdrl. asv., inter-sed.	*Cl.* cub. (perf.) *Fr.* gran.	$(Co,Fe)AsS$	G. 6. BB gives off S and As and fuses to magnet. button. Sol. in warm HNO_3, separating arsenic oxide and sulphur. *A.* Chalcopyrite, Pyrrhotite (Magnetopyrite), Molybdenite, Amphibole, Pyroxene.
m. olmn., acic., pyr. asv., inter-sed.	*Cl.* I (seldom). *Fr.* fine gran., thin stalky.	$FeAsS$ or $Fe(AsS)_2$	G. 6. Crystals deficient in facets. Often tarnished gray or bright. BB As odor. Gives magnetic button. Decomp. by HNO_3, separating arsenic acid and S. *A.* Blende, Galenite, Chalcopyrite, Pyrite, Magnesite, Cassiterite.
1.	*Cl.* cub. (perf.)	$NiSbS$	G. 6.3. Closed tube, faint white subl. Open tube, sulph. and antimon. fumes, the latter condensing on the sides, and not vol. BB fuses to button, boils and gives antimon. vapors which coat coal. Decomp. by HNO_3, forming green sol., with separation of sulphur and antimon. ox. *A.* Galenite, Chalcopyrite.

NAME.	COLOR.	STREAK.	HARD'SS.	TENACITY.
Skutterudite‡ (Tesseralkies)	tin-white	grayish black	5.75	brittle
Sperrylite				
Iridosmine‡ (Sisserskite) (Newjanskite)	tin-white	grayish black	7	brittle
Lead				
Molybdenite (Molybdänglanz)	reddish lead-gray	bluish gray, lustrous	1.5	sectile to malleable
Nagyagite‡ (Blättertellurerz)	black lead-gray to iron-black	grayish black	1.5	sectile to malleable
Beegerite				
Sylvanite† (Schrifterz) (See p. 6.)	light steel-gray	gray	2	sectile
Pyrolusite (Weichmanganerz)	dark steel-gray to light iron-black	black	2	sect. to britt

CRYSTAL SYSTEM, HABIT, AND STRUCTURE.	CLEAVAGE AND FRACTURE.	CHEMICAL FORMULA.	REMARKS. Sp. Gr., Reactions. *A* = Associated Minerals.
Isom. *H.* octdl. *S.* massive.	*Cl.* cub. (distinct)	$CoAs_3$	G. 6.7. In matrass subl. of met. arsenic. Open tube white fumes of arsen. acid. BB As odor. Fuses to button. *A.* Cobaltite and ores of Co, Ni, Cu, Ag.
Hex. *H.* r'dl, scaly.	*Cl.* 0	xIr + yOs (with Rd, Pt, Cu, Fe, Ru)	G. 19.3–21.12. BB infusible. At high temp. Sisserskite gives off Osmium, but suffers no other change. Newjanskite gives no Osmium odor till fused with nitre. *A.* Gold and Platinum.

Gray.

Hex. *H.* fine tab., scaly. *S.* interspersed, massive.	*Cl.* basal (perfect.) *Fr.* thin shelly	MoS_2	G. ± 4.6. Gray streak on paper and unglazed porcelain. Greenish streak on glazed porcelain. Unctuous to touch; cut by the nail. Laminæ flexible but not elastic. BB yellowish green flame. In O.F. odor of SO_2 and coats coal with MoO_3. Yellow hot; white, cool, and red near substance. With intermittent flame azure blue. Decomp. by nitr. ac. with residue of MoO_3. *A.* Wolframite, Arsenopyrite, Cassiterite, Magnetite, Blende, Pyrite.
O'rhm. *H.* fine tab., scaly. *S.* interspersed.	*Cl.* basal (perfect)	$Au_2Pb_{14}Sb_8(S,Te)_{24}$	G. 6.9. BB two coats, most distant white and volatile, that nearest substance yellow. *A.* Blende, Tetrahedrite, Rhodocrosite, Sylvanite.
Mcl. *H.* short acic., scaly. *S.* interspersed.	*Cl.* i–ì (distinct)	$(Ag,Au)Te_2$	G. ± 8.15. In open tube white subl., gray near substance, fusing BB to clear, transparent drops. *Ch.* fuses and gives white coat, which in R.F. disappears, giving bluish-green color to flame. *A.* Tetrahedrite, Blende.
O'rhm. (pseud.) *H.* colmn., acic., capil. *S.* massive.	*Fr.* stalky, fibr., gran.	MnO_2 with 2 p. c. H_2O	G. 4.8. Blackens objects touched. BB infusible. Loses oxygen. Gives Cl with HCl. *A.* Psilomelane, Barite.

NAME.	COLOR.	STREAK.	HARD'SS.	TENACITY.
Tetradymite† (Tellurwismuth)	pale steel-gray to silver-white	dark gray	2	sectile to ma leable
Aikinite				
Jamesonite† (Federerz)	black lead-gray to steel-gray	gray-black	2.5	sect. to britt
Emplectite† (Kupferwismuthglanz)	tin-white to light steel gray	gray-black	2.5	sect. to britt
Stibnite (Antimonite) (Grauspiessglaserz) (Antimonglanz)	lead-gray	grayish black	2.5	sectile
Schirmerite				
Freieslebenite‡ (Schilfglaserz) (Diaphorite with same formula crystallizes O'rhmb.)	steel-gray to black lead-gray	gray-black	2.5	sect. to brittl
Argentite	black lead-gray	gray-black lustrous	2.5	malleable

CRYSTAL SYSTEM, HABIT, AND STRUCTURE.	CLEAVAGE AND FRACTURE.	CHEMICAL FORMULA.	REMARKS, Sp. Gr., Reactions. *A* = Associated Minerals.
Hex. *H.* acute r'dl., scaly, tab. *S.* massive.	*Cl.* basal (perfect)	$Bi_2(Te,S)_3$	G. 7.2–7.9. Crystals small. Melts in candle flame. Laminæ flexible. Marks paper. Open tube white subl. of tellur. oxide, which BB fuses to colorless drop. *Ch.* fuses, white fumes, and entirely vol. Tinges R.F. bluish green. Coats first white and then orange-yellow. *A.* Gold.
O'rhm. *H.* acic., capil. *S.* massive.	*Cl.* basal (distinct). *Fr.* stalky, fibr., compact.	$Pb_2Sb_2S_5$	G. 5.7. Melts in candle flame. Decrepitates, subl. of Sb_2S_3. BB almost entirely vol., giving coat white near outer edge, yellow near assay. *A.* Galenite, Bournonite.
O'rhm. *H.* acic. *S.* massive.	*Cl.* i–ī (perfect). 0 distinct. *Fr.* thin, stalky.	$Cu_2(Bi,S_2)_2$	G. 5.15. Melts in candle flame. Often tarnishes yellow. BB *ch.* fuses easily with frothing and spirting. With soda coats dark yellow from Bi_2O_3 and gives button of Cu. *A.* Chalcopyrite.
O'rhm. *H.* acic., tab., columnar. *S.* stalky, fibr., gran., compact.	*Cl.* i–ī (highly perfect). Cl. planes often striated.	Sb_2S_3	G. 4.5. Often tarnished in bright colors. Melts in candle flame. Open tube S and Sb fumes, the latter not vol. BB *ch.* white coat, coloring greenish blue in R.F. Sol. in HCl. *A.* Siderite, Blende, Barite, Quartz, Pyrite, Gold.
Mcl. *H.* short acic. *S.* masv., interspersed.	*Fr.* compact, fine grained	$(Pb,Ag_2)_5Sb_4S_{11}$	G. ± 6.2. Melts in candle flame. BB *ch.* coats white on outer edge, yellow near substance. R.F. silver button. *A.* Pyrargyrite, Barite, Siderite.
Isom. *H.* hxhdl., octdl., dodecl. *S.* masv., interspersed, coating, lamellar, reticulated.	.....	Ag_2S	G. 7.2. BB *ch.* fuses with intumescence, emitting S fumes, and yielding Ag button. *A.* Pyrargyrite, Proustite, Silver, Galenite, Blende, Niccolite, Barite, Fluorite, Siderite.

NAME.	COLOR.	STREAK.	HARD'SS.	TENACITY.
Bismuthinite† (Wismuthglanz)	light steel-gray	black	2.5	sect. to britt
Clausthalite‡ (Selenblei)	lead-gray	grayish black	2.5	sectile
Zinkenite ‡ (Bleiantimon-glanz)	lead-gray	grayish black	2.5	sect. to brittl
Onofrite				
Argyrodite				
Galenite (Bleiglanz)	reddish lead-gray	dark gray	2.75	sectile
Chalcocite (Kupferglanz)	black lead-gray	dark gray	2.75	sect. to brittl

L SYSTEM, IT, AND ICTURE.	CLEAVAGE AND FRACTURE.	CHEMICAL FORMULA.	REMARKS. Sp. Gr., Reactions. A = Associated Minerals.
il., acic. sive.	*Cl.* i–ĭ (perf.)	Bi_2S_3	G. 6.4. Melts in candle flame. In open tube S fumes and white subl., which BB fuses into drops. Brown when hot and opaque yellow cold. *Ch.* fuses, with spirting, and coats yellow. Dissolves in nitr. ac., and white precip. falls on diluting with water. *A.* Bismuth, Chalcopyrite, Gersdorffite, Siderite, Cassiterite, Wolframite, Molybdenite.
rspersed, e.	*Cl.* cubic (perfect). *Fr.* fine-gr.	PbSe	G. 7.6 to 8.8. BB decrepitates in closed tube. Open tube, selenous fumes and red subl. *Ch.* gray near substance, with red border. Later, yellow. Partially fusible. Entirely vol. Resembles Galenite, but BB distinguish it. *A.* Gold.
., colmn. sive.	*Fr.* stalky	$PbSb_2S_4$	G. 5.3. Crystals seem hex. Melts in candle flame. Decrep. and fuses easily. BB almost entirely vol. Coat yellow near substance, white further off. Sol. in hot HCl, evolving H_2S and precip. $PbCl_2$ on cooling. Resembles Stibnite and Bournonite, but is harder and heavier. *A.* Galenite, Antimonite.
ıdl., v., interl, coatb.	*Cl.* cubic (perfect). *Fr.* gran., compact, thin scaly, broad stalky.	PbS	G. 7.5. BB *ch.* coats coal yellow and gives button of lead. Sol. in nitr. ac. *A.* Blende, Chalcopyrite, Pyrite, Barite, etc. In veins and beds.
., short obtuse v., interl, tab.	*Cl.* 0 observable	Cu_2S	G. 5.7. BB yields nothing vol. in closed tube. SO_2 in open tube. R.F. with soda metallic Cu. *A.* Chalcopyrite, Bornite, Tetrahedrite, Malachite, Pyrite, Barite.

NAME.	COLOR.	STREAK.	HARD'SS.	TENACITY.
Bournonite† (Rädelerz)	steel-gray to iron-black	grayish black	2.75	brittle to se
Boulangerite†	lead-gray	grayish black	2.75	sect. to brit
Wittichenite‡	lead-gray to iron-black	grayish black	2.75	sectile
Tiemannite‡ (Selenqueck-silber)	lead-gray	grayish black	2.75	sect. to brit
Binnite				
Petzite				
Stephanite† (Brittle silver ore, Melanglanz)	black lead-gray to iron-black	grayish black	2.75	sect. to brit
Berthierite†	lead-gray to dark steel-gray	grayish black	3	brittle
Frenzelite				
Dufrenoysite‡	blackish lead-gray	reddish brown	3	very brittle
Jordanite				

CRYSTAL SYSTEM, HABIT, AND STRUCTURE.	CLEAVAGE AND FRACTURE.	CHEMICAL FORMULA.	REMARKS. Sp. Gr., Reactions. A = Associated Minerals.
O'rhm. *H.* tab., cuboid, obt. pyr. *S.* masv., intsp.	.....	$Pb_2Cu_2Sb_2S_6$	G. 5.8. Crystals seem tetragonal. Multiple twin structure. Often cruciform. In closed tube, decrep. and gives dark-red subl. BB *ch.* fuses easily and coats white outside and yellow near substance. R.F. with soda, button of Cu. Decomp. by nitr. ac., leaving residue of S, and white powder containing Sb, and Pb in blue solution. *A.* Tetrahedrite, Galenite, Chalcopyrite. Arsenopyrite, Siderite, Barite.
O'rhm. *S.* massive.	*Fr.* thin stalky, fibr., compact	$Pb_3Sb_2S_6$	G. 5.8. Melts in candle flame. BB, see ZINCKENITE. *A.* Galenite, Antimonite.
O'rhm.	.....	$(Cu_2)_3Bi_2S_6$	G. 5. BB fuses easily, emits sparks. Coats coal with bismuth oxide. Sol. in HCl, ac. with evolution of H_2S. Decomp. by nitr. ac. with separation of S. *A.* Barite.
Isom. *H.* tetrdl.	.....	Hg Se	G. 7.2. Decrepitates and sublimes in closed tube, giving black subl., upper edge reddish brown. Open tube, odor of Se. Forms dark reddish brown subl., with border of white selenate of Hg. BB *ch.* volatile, coloring outer flame azure and leaving metallic coating. *A.* Chalcopyrite.
O'rhm. *H.* tetrdl., thick tab., short and long colmn. *S.* masv., interspersed.	.....	$Ag_{10}Sb_2S_8$	G. 6.2. Crystals seem hxgnl. Melts in candle flame. BB *ch.* fuses with spirting. Coats coal with antimony oxide, and gives button of silver. Soluble in dilute hot nitr. ac., precipitating S and antimony oxide. *A.* Argentite, Silver, Pyrargyrite, Barite.
(?) *H.* capillary. *S.* massive.	*Cl.* in one direction. *Fr.* thin stalky, fibr.	$FeSb_2S_4$	G. 4.1. Melts in candle flame. Often brightly tarnished. BB *ch.* gives off S and Sb fumes. Coats coal white and leaves black magnetic slag. Dissolves in HCl, giving off H_2S. *A.* Antimonite, Blende.
O'rhm. *H.* thick tab.	*Cl.* 0 (perf.)	$Pb_2As_2S_5$	G. 5.5. BB *ch.* decrepitates, melts, yields fumes of As and button of argentif. lead. *A.* Sartorite, Jordanite, Binnite.

NAME.	COLOR.	STREAK.	HARD'SS.	TENACITY.
Sartorite‡ (Scleroclase, Bleiarsenglanz)	light lead-gray	reddish brown	3	very brittle
Miargyrite† (Silberantimonglanz)	steel-gray to iron-black	dark cherry-red	3	sect. to britt
Guitermanite				
Arsenic†	lead-gray to tin-white	grayish black	3.5	brittle to se
Tenorite				
Tetrahedrite (Antimonfahlerz. Common variety)	dark steel-gray lead-gray iron-black	black in part, inclining to cherry-red	3.5	brittle
Tetrahedrite (Tennantite, Arsenfahlerz)	dark steel-gray	dark red-gray to dark cherry-red	3.5	brittle
Tetrahedrite† (Hermesite, Quecksilberfahlerz)	steel-gray	black	3.5	brittle to se
Stannite† (Stannin, Zinnkies)	steel-gray to gray	black	3.5	brittle
Manganite (See I. 5)	dark steel-gray	reddish brown	4.25	sect. to brit
Gersdorffite† (Graunickelkies, Arsennickelkies)	lead-gray to tin-white	grayish black	5	brittle

'AL SYSTEM, ıBIT, AND RUCTURE.	CLEAVAGE AND FRACTURE.	CHEMICAL FORMULA.	REMARKS. Sp. Gr., Reactions. *A* = Associated Minerals.
n.	*Cl.* 0 distinct	$PbAs_2S_4$	G. 5.4. BB nearly the same as Dufrenoysite, but differing in strong decrepitation. *A.* Dufrenoysite, Binnite.
ıick tab., colmn. assive.	.....	$AgSbS_2$	G. 5.3. Melts in candle flame. BB *ch.* fuses to gray bead, emitting S and Sb fumes. In O.F. leaves button of Ag. *A.* Pyrargyrite.
ıdrl.	*Cl.* 0 perfect. R and $-\frac{1}{2}$ R distinct.	As	G. 5.9. Fresh surfaces of fracture tarnish in short time to grayish black. Vol. without melting. Crystals very rare and small. Ignites in candle flame. BB *ch.* odor of garlic. Coats with As oxide. Coating vol. in R.F., tingeing flame blue. *A.* Proustite, Galenite, Chloanthite, Barite, Calcite.
·trdl., el., $\frac{m.m}{2}$. ısv., intsp.	.....	$(Cu_2Ag_2,Fe,Zn)_4Sb_2S_7$	G. 4.5–5.1. BB *ch.* fuses, giving coating of antimony oxide. Decomp. by nitr. ac., with separation of S and antimon. ox. *A.* Chalcopyrite, Galenite, Bournonite, Blende, Siderite, Rhodocrosite, Barite.
·trdl., el. asv., intsp.	.....	$(Cu_2,Fe,Zn)_4As_2S_7$	G. ± 4.7. BB, etc., as in preceding, with As ox. for Sb ox. *A.* Chalcopyrite, Galenite, Blende.
·trdl.	.....	$(Cu_2,Hg_2,Fe,Zn)_4(Sb,As)_2$	G. ± 4.7. Melts in candle flame. BB faint dark gray subl. at low red heat. Fused with soda in matrass drops of Hg condense on sides. *A.* Cinnabarite, Chalcopyrite, Siderite, Barite.
emihdrl. assive.	*Fr.* compact, fine-grained	Cu_2FeSnS_4	G. 4.4. Tarnishes bronze-yellow. Gives no malleable button. Sol. in nitr. ac., with separation of S and SnO_2. *A.* Chalcopyrite, Cassiterite, Arsenopyrite, Galenite, Blende.
m.	i–ĭ, I	MnO,OH	G. 4.3. (See L. 5.)
ctdl. assive.	*Cl.* cubic rather perfect. *Fr.* granular.	(Ni,Fe)AsS	G. 6. Often tarnishes dark gray. Decrepitates and gives subl. of As sulphide. BB sulph. and garlic odor. Decomp. by nitr. ac., forming green solution, separating S and As ox. *A.* Niccolite, Siderite.

NAME.	COLOR.	STREAK.	HARD'SS.	TENACITY.
Smaltite (Smaltin, Speiskobalt)	steel-gray to blue-gray	grayish black	5	brittle
Platinum†	light steel-gray	gray	5.75	malleable
Iron (Meteoric)	light steel-gray	gray	6	malleable
Polianite† (Var. Pyrolusite)	light steel-gray	grayish black	6	brittle
Rutile (See II. 2)	brownish gray	yellowish red	6.5	brittle
Hematite (Specularit, Eisenglanz, Rotheisenerz)	steel-gray to iron-black	cherry-red brown-red reddish brown	6.5	brittle
Graphite	iron-black	black	1	sectile to malleable
Nagyagite (Blättertellurerz) (See I. 4)	iron-black	grayish black	1.5	sectile to malleable

CRYSTAL SYSTEM, HABIT, AND STRUCTURE.	CLEAVAGE AND FRACTURE.	CHEMICAL FORMULA.	REMARKS. Sp. Gr., Reactions. A = Associated Minerals.
Isom. *H.* hemihdrl. *S.* masv., interspersed, reniform, retic.	*Fr.* compact, short fibr., fine-grained	$(Co,Fe,Ni)As_2$	G. 6.7. Often with peach-blossom tarnish or dark gray. BB *ch.* garlic odor and fuses to a button. *A.* Niccolite, Bismuth, Barite, Fluorite.
Isom. *H.* hxhdl. *S.* free grains, and intersp. in lumps.	*Fr.* angular, granular	Pt (containing Fe, Ir, Os, etc.)	G. 16–19. Tarnishing grayish black. Infusible. Insoluble in single acids. Soluble in aq. reg. *A.* Chromite, Gold, Iridosmine.
Isom. *S.* masv., interspersed.	*Cl.* cubic partly distinct	Fe (containing Ni, Co, Si, Mg, etc.)	G. 7.5. Magnetic. BB infusible. Sol. in HCl. Generally meteoric.
Tetrag. *H.* short colmn, short acic. *S.* masv., reniform.	*Cl.* I distinct ii less so	$MnMnO_4$	G. 4.8. BB *ch.* infusible. Loses oxygen. Mn reaction with borax. Gives Cl with HCl. *A.* Pyrolusite, Barite.
Tetrag.	*Cl.* ii	$TiTiO_4$	G. 4.
Hex. *H.* r'drl., lentic., pyr., scaly, tab. *S.* masv., intsp.	*Cl.* R seldom distinct. *Fr.* gran., stalky, scaly, slaty, compact.	Fe_2O_3	G. 4.8. BB infusible. Sometimes magnetic and magneto-polar. Often tarnished in bright colors. Reactions for iron. *A.* Limonite, Göthite, Pyrolusite, Psilomelane.

Black.

Hex. *H.* r'drl., thin tab., scaly. *S.* masv., intsp.	*Cl.* 0 perfect. *Fr.* scaly, compact.	C (with impurities, chiefly Fe_2O_3)	G. 2.15. Greasy feel. BB burns without melting. Soils white paper. Unaltered by acids. *A.* Gneiss, Mica-slate, Limestone.
Tetrag.	*Cl.* 0 perfect	$Au_2Pb_{14}Sb_3(Te,S)_{24}$	G. 6.9

NAME.	COLOR.	STREAK.	HARD'SS.	TENACITY.
Pyrolusite (Weichmanganerz)	light iron-black to dark steel-gray	black	2	sect. to britt
Aguilarite				
Acanthite†	iron-black	gray-black	2.5	malleable
Polybasite† (Eugenglanz, Sprödglaserz, in part)	iron-black	black	2.5	sect. to britt
Stromeyerite‡ (Silberkupferglanz)	iron-black	black, lustrous	2.75	sect. to mall
Wittichenite‡ (See I. 4)	iron-black to lead-gray	gray-black	2.75	sectile
Stephanite† (Melanglanz, Sprödglaserz. in part)	iron-black to black lead-gray	gray-black	2.75	mild
Chalcocite (Kupferglanz) (See I. 4)	black lead-gray to iron-black	black	2.75	sect. to mall
Bournonite† (See I. 4)	iron-black to steel-gray	gray-black	2.75	brittle to mil
Metacinnabarite				
Enargite‡	iron-black	black	3	brittle
Coloradoite				
Miargyrite† (See I. 4)	iron-black to steel-gray	dark cherry-red	3	sectile

TAL SYSTEM, ABIT, AND RUCTURE.	CLEAVAGE AND FRACTURE.	CHEMICAL FORMULA.	REMARKS. Sp. Gr., Reactions. *A* = Associated Minerals.
m. olmn., acic., . assive.	*Fr.* stalky, fibr., gran.	MnO_2 (with 1 or 2 p. c. H_2O)	G. 4.8. Infusible. Soils white paper. BB *ch.* loses oxygen. Gives Cl with HCl. *A.* Psilomelane, Barite.
m. art-like, ades.	.....	Ag_2S	G. 7.2. BB yields SO_2, and gives silver button with soda. *A.* Argentite.
m. caly, tab. terspersed.	*Cl.* **0** (dist.)	$(Ag,Cu)_{18}(Sb,As)_2S_{12}$	G. 6.2. Translucent in thin slabs. Melts in candle flame. BB *ch.* fuses, with spirting, to button, giving S and Sb fumes. *A.* Stephanite, Argentite, Siderite, Fluorite, Barite.
m.	*Fr.* sub-conchoidal	$(Cu,Ag)_2S$	G. 6.2. Closed tube, fuses; gives no subl. Open tube, S fumes. BB *ch.* O.F. fuses to semi-malleable button. Sol. in nitr. ac.
m.	.....	$(Cu_2)_3Bi_2S_6$	G. 5.
m. hick tab., and long mnar. asv., inter- ged.	.....	$Ag_{10}Sb_2S_8$	G. 6.2. Crystals seem hex. Melts in candle flame. BB *ch.* fuses, throwing off small particles. Coats coal with Sb ox. After time red, from oxidized silver. Sol. in hot nitr. ac., depositing S and Sb. *A.* Argentite, Pyrargyrite, Silver, Barite.
m.	*Cl.* **0**	Cu_2S	G. $\pm$ 5.6.
m. ort colmn, cuboid, se pyr.	.....	$Pb_2Cu_2(SbS_3)_2$	G. 5.8.
m. hort colmn, t acic. assive.	*Cl.* I perfect ii } dist. ii }	Cu_3AsS_4	G. 4.4. BB in closed tube decrep. and gives subl. of S; at higher temp., subl. of arsenous sulphides. Fuses on *ch.* and gives button of copper. *A.* Tennantite, Chalcopyrite.
	.....	$Ag(SbS_2)$	G. 5.3. (See I. 4.)

NAME.	COLOR.	STREAK.	HARD'SS.	TENACITY.
Tetrahedrite‡ (Antimonfahlerz) (See I. 4)	iron-black	brown-black	3.5	brittle
Alabandite‡ (Manganblende)	iron-black	dark green	3.75	brittle to se
Manganite†	iron-black	reddish brown	4.25	sect. to brit
Melaconite† (Tenorite)	iron-black	black	5	brittle to se
Hausmannite†	iron-black	brown sometimes reddish brown	5.5	brittle
Magnetite (Magneteisenerz)	iron-black	blackish gray	5.5	brittle
Jacobsite				
Menaccanite† (Ilmenite, Titaneisenerz)	iron-black	black reddish brown	6	brittle
Chromite† (Chromeisenerz)	iron-black	dark brown to light brown	6	brittle
Braunite (Marcellin) (See II. 1)	iron-black	brownish black	6.25	brittle

CRYSTAL SYSTEM, HABIT, AND STRUCTURE.	CLEAVAGE AND FRACTURE.	CHEMICAL FORMULA.	REMARKS. Sp. Gr., Reactions. *A* = Associated Minerals.
Isom.	.....	.....	G. 4.5 to 5.1. (See I. 4.)
Isom. *H.* octdl.	*Cl.* cubic (distinct)	MnS	G. 4. Often tarnishes dark brown. BB infusible. *A.* Blende, Rhodocrosite.
O'rhm. *H.* acic., colmn. *S.* massive.	*Cl.* ii very perf. I perfect. *Fr.* thin stalky, fibr.	MnO.OH	G. 4.3. BB infusible. Yields water. Borax and mrcrsm. salt, amethystine bead; colorless in R.F. Gives Cl with HCl. *A.* Barite, Calcite.
Mcl. (?)	.....	CuO	G. 6. Usually in scales. Soils fingers. BB O.F. infus. Colors flame green. Moistened with HCl, azure blue. Sol. in concentrated HCl. *A.* Found in lava on Vesuvius and in some copper mines.
Tetrag. *H.* acute pyr. *S.* massive.	*Cl.* 0 distinct. *Fr.* granular.	Mn_2MnO_4	G. 4.7. BB infusible. (See MANGANITE, above.) *A.* Pyrolusite, Psilomelane, Braunite, Barite.
Isom. *H.* octdl., dodecl. *S.* masv., intsp.	*Fr.* compact, granular	$Fe(FeO_2)_2$	G. ± 5. Strongly magnetic. BB fusible with great difficulty. In oxidizing flame loses magnetism. Sol. in HCl. *A.* In eruptive and metamorphic rocks.
Hex. *H.* r'drl., tab. *S.* masv., interspersed.	*Cl.* R rarely. *Fr.* granular.	$(Fe,Ti)_2O_3$	G. 4.7. BB infusible. Partly magnetic. O.F. slightly rounded on edges. With mrcrsm. salt reaction for iron. In R.F., treated with tin, violet color. Powdered and heated with HCl, slowly dissolved to yellow sol. *A.* Rutile, Titanite, Apatite, Feldspar.
Isom. *H.* octdl. *S.* masv., interspersed.	*Fr.* granular, compact	$(Fe,Cr)[(Cr,Fe)O_2]_2$	G. 4.3. Crystals small and rare. Usually slightly magnetic. BB infusible. With borax and mrcrsm. salt, iron reaction hot and chrome-green cold. *A.* In Serpentine.
Tetrag.	*Cl.* I	$MnMnO_3$	.....

NAME.	COLOR.	STREAK.	HARD'SS.	TENACITY.
Franklinite†	iron-black	reddish brown	6.25	brittle
Långbanite				
Rutile (See II. 2)	iron-black	yellowish brown	6.5	brittle
Hematite (Specularite)	iron-black to steel-gray	cherry-red brown-red black-red	6.5	brittle
Columbite (Niobite)	iron-black	brownish black	6	brittle

CRYSTAL SYSTEM, HABIT, AND STRUCTURE.	CLEAVAGE AND FRACTURE.	CHEMICAL FORMULA.	REMARKS. Sp. Gr., Reactions. *A* = Associated Minerals.
Isom. *H.* octdl. *S.* massive.	*Fr.* compact	$(Fe,Mn,Zn)(FeO_2)_2$	G. 5. BB infusible. Slightly magnetic. With borax in O.F. reddish amethyst bead (Mn), and in R.F. bottle-green (Fe). *A.* Zincite, Willemite.
Tetrag.	*Cl.* ii, I	$Ti\,Ti\,O_4$	G. 4.
Hex. *H.* r'drl., tab., pyr.	*Cl.* R (seldom distinct)	Fe_2O_3	G. 4.8. BB infusible. Sometimes magnetic and magneto-polar.
O'rhm.	*Cl.* ii distinct	$[(Nb,Ta)O_3]_2Fe$	G. 6. BB infusible. Like Tantalite. Decomp. by fusion with potash, and treated with HCl and H_2SO_4 gives on addition of Zn a blue color. *A.* Beryl in Granite.

II. MINERALS OF SUB-METALLIC

OF BLACK, BROWN, RED,

1. Of Black Streak

NAME.	LUSTRE.	COLOR.	STREAK.	HARD'SS.	TENACITY.
Asbolite† (Erdkobalt)	slightly resinous	bluish black	bluish black	1.25	sectile to malleable
Asphaltum† (Erdpech)	resinous	pitch-black	black to brown	1.25	sectile
Covellite† (Kupferindig)	sub-metal. to adamantine	dark blue indigo-blue steel-blue	blue-black	1.5–2	sectile to brittle
Bituminous Coal	resinous to vitreous or silky	black partly brown	black	2.5	sectile to brittle
Anthracite	sub-metallic vitreous	black	black	2.75	very brittle
Lithiophorite					
Enargite (See I. 5)	sub-metallic	iron-black	black	3	brittle
Warwickite					
Sphalerite† (Blende, Zinkblende)	vitreous	black	brownish black	4	brittle

AND NON-METALLIC LUSTRE

YELLOW, GREEN, OR BLUE STREAK.

(all Opaque).

CRYSTAL SYSTEM, HABIT, AND STRUCTURE.	CLEAVAGE AND FRACTURE.	CHEMICAL FORMULA.	REMARKS. Sp. Gr., Reactions. *A* = Associated Minerals.
Amorphous. *S.* botryoidal, massive, powdery, coating.	.....	$Co(Fe,Cu)O + xH_2O$	G. ± 3.5. Unctuous. Variety of Wad. BB infusible. Blue bead with mercsm. salt. *A.* Malachite, Barite, Tetrahedrite.
Amorphous. *S.* massive, incrustations.	*Fr.* conchoidal	$C_{14}H_{18}O$	G. ± 1.5. Sticky. Ignitible by candle flame, and burning with light. *A.* In limestone, marl, clay, sandstone.
Hex. *H.* r'dl., thin tab. *S.* masv., lamellar, coating, powdery.	*Cl.* 0 and I observable. *Fr.* compact, fine and small-grained, stalky.	Cu S	G. 4. Crystals very rare. Ignitible in candle flame and burning with blue flame. (BB, see CHALCOCITE, I. 4.) *A.* Chalcopyrite, Pyrite.
Amorphous. *S.* massive.	*Fr.* conchoidal to plane, compact, slaty, fibr.	C, H, O with ash	G. 1.4–1.6. Ignitible by a candle, and burning with light. *A.* Pyrite.
Amorphous. *S.* massive.	*Fr.* conchoidal, compact	C with little H, O, etc., and ash	G. ± 1.7. Not ignitible by candle flame. Hard to ignite and burning with little or no flame. *A.* Slate, Pyrite.
O'rhm.	*Cl.* I perfect	Cu_3AsS_4	G. 4.4.
Isom. *H.* octdl., hxdl., tetrdl., dodecl. *S.* masv., intsp., reniform, spheroidal.	*Cl.* I highly perfect. *Fr.* granular, compact, scaly, fibrous.	(Zn,Fe,Mn,Cd)S	G. 4. BB fusible with great difficulty. *Ch.* some varieties reddish brown coating of Cd oxide take a white coat of zinc oxide, yellow hot, and white when cold. *A.* Arsenopyrite, Magnetite, Chalcopyrite, Magnetopyrite, Galenite, Garnet, Pyroxene.

NAME.	LUSTRE.	COLOR.	STREAK.	HARD'SS.	TENACITY.
Ludwigite					
Uraninite† (Uranpecherz)	resinous partly metal.	black	grayish black to brownish black	5.5	brittle
Dysanalyte					
Ilvaite‡ (Lievrite)	resinous to semi-metal.	black	greenish black	5.75	brittle
Columbite‡ (Niobit)	vitreous adamantine metalloid	black	grayish to brownish black	6	brittle
Psilomelane (Hartmanganerz)	sub-metal. to non-metal.: lustre of streak greater	bluish black	black, in part brown	6.25	brittle
Braunite† (Marcellin)	sub-metallic	black	black	6.25	brittle
Schorlomite					

2. Of

Bog Manganese (Manganschaum, Groroilith, Wad)	glistening	black-brown to blue-black	black-brown	1	sectile
Ozocerite‡ (Erdwachs)	resinous	brown	yellow-brown	1	ductile
Chloropal‡ (Fettbol, Gramenit, Pinguit, Nontronit)	resinous	liver-brown	liver-brown.	1.75	sectile

CRYSTAL SYSTEM, HABIT, AND STRUCTURE.	CLEAVAGE AND FRACTURE.	CHEMICAL FORMULA.	REMARKS. Sp. Gr., Reactions. *A* = Associated Minerals.
Isom. *H.* octdl. *S.* masv., interspersed, reniform.	*Fr.* compact, conchoidal to uneven	$(U,Pb_2)_3(UO_6)_2$(?)	G. 6.4.–8. Crystals rare. BB fusible with great difficulty, coloring outer flame green. With borax and mrcrsm. salt, yellow bead in O.F. becoming green in R.F. (Uranium). *A.* Torbernite, Galenite, Chalcopyrite, Chloanthite, Bismuth, Pyrargyrite, Barite, Fluorite, in granite.
O'rhm. *H.* colum., acic. *S.* massive.	*Cl.* ii distinct. *Fr.* stalky.	$Fe_2Ca(Fe.OH)(SiO_4)_2$	G. ± 4. BB infusible. Gelatinizes with HCl. *A.* Amphibole, Pyroxene.
O'rhm. *H.* short colum., short acic., tab. *S.* interspersed.	*Cl.* ii distinct	$Fe(NbO_3)_2$ or $Fe((Nb,Ta)O_3)_2$	G. ± 6. BB infusible. (See I. 5.) *A.* Beryl, in granite.
Amorphous. *S.* reniform, botrydl., masv.	*Fr.* conchoidal to uneven	Principally Manganate of Manganese. Much of latter replaced by Ba. Some Ca, Mg, Cu, Al, Fe, and alkalies with H_2O.	G. ± 4. Surface of nodules generally smooth. BB infusible; loses O. Yields Cl with HCl. *A.* Pyrolusite, Polianite, Limonite, Barite.
Tetrag. *H.* pyramidal. *S.* massive.	*Fr.* uneven, gran., compact	$Mn.MnO_3$. Contains also some Manganese Silicate.	G. ± 4.7. Crystals small. Evolves Cl with HCl. BB infusible. With borax and mrcrsm. salt, amethyst. bead in O.F. becoming colorless in R.F. *A.* Pyrolusite, Psilomelane, Hausmannite, Barite.

Brown Streak.

Amorphous. *S.* reniform, botrydl., masv.	*Fr.* uneven, earthy	Mostly MnO_2 with MnO and 5 to 14 p. c. of H_2O. Contains limonite, calcite, and other subst'nes	G. ± 3.7. Opaque. Greasy to touch. BB infusible. (See PSILOMELANE, II. 1.) *A.* Psilomelane, Pyrolusite, Limonite, Siderite.
Amorphous. *S.* massive.	*Fr.* compact, fibrous	Hydrocarbon of Methane series of high boiling-point.	G. 0.95. Aromatic odor. Sticky. Inflammable with bright flame. *A.* Bituminous coal, bituminous clay slate.
Amorphous. *S.* massive, earthy.	*Fr.* conchoidal, earthy	$(Fe,Al)_2(SiO_3)_3.5H_2O$	G. 1 7. Opaque. Greasy feel. BB yields water. Infusible, but blackens and becomes magnetic. Partially decomposed by HCl. *A.* Barite, Fluorite.

NAME.	LUSTRE.	COLOR.	STREAK.	HARD'SS.	TENACITY.
Asphaltum‡ (Erdpech) (See II. 1)	resinous	black to brown	brownish black	2	sectile to brittle
Manganostibiite					
Plattnerite (Schwerbleierz)	metallic adamantine	iron-black	brown	.....	brittle
Lignite (Braunkohle)	resinous	brown to black	brown, partly black	2.5	sect., partly brittle
Chrysocolla (Kieselkupfer)	vitreous, resinous, earthy	green (brown or black when impure)	greenish brown	3.5	brittle
Neotocite					
Siderite (Eisenspath)	vitreous to pearly	pale yellow, yellow-brown	yellowish brown	4	brittle
Sphalerite (Blende) (See II. 1)	vitreous to adamantine	black to brown	black-brown pink-brown light brown	4	brittle
Xenotime					
Göthite (Lepidocrocite)	adamantine, velvety, silky	brown	yellowish brown	4.5	brittle
Allactite					
Arseniopleite					
Wolframite† (Hübnerite)	sub-metallic and adamantine	black	red-brown black-brown	5	brittle
Polycrase					
Fergusonite					
Samarskite					
Limonite (Brauneisenerz)	non-metallic	brown	yellow-brown	5.5	brittle

;TAL SYSTEM, ABIT, AND TRUCTURE.	CLEAVAGE AND FRACTURE.	CHEMICAL FORMULA.	REMARKS. Sp. Gr., Reactions. A = Associated Minerals.
orphous	*Fr.* conchoidal	$C_{14}H_{18}O$	G. 1.5.
olumn. oating, idomorphs.	*Fr.* uneven	PbO_2	G. 9.4.
orphous. nassive.	*Fr.* earthy, compact, fibr.	More or less carburized vegetable matter containing C, H, O, N, S, and ash	G. ± 1.4. Opaque. Inflammable in the candle flame, and burning with light. *A.* Pyrite, Marcasite, Sulphur, Gypsum.
orphous. nasv., intsp., form.	*Fr.* conchoidal, compact, earthy	$CuSiO_3.2H_2O$, often with some Al silicate	G. 2.1. Opaque. Closed tube, blackens and gives water. BB decrepitates, and colors flame green. Infusible. Frequent in cap rock. *A.* Malachite, Chalcopyrite, Chalcocite, Cuprite.
dl., obtuse acute R, enohdrl. nasv., reni- n, warty, ular, lamel.	*Cl.* R 107° perfect, partly curved faces. *Fr.* granular, shelly, compact.	$FeCO_3$. Contains often Mg, Mn, and Ca.	G. 3.8. Brown by weathering. In closed tube decrepitates and becomes magnetic. BB infusible. Blackens. By exposure it darkens. Effervesces in weak acid. *A.* Galenite, Blende, Chalcopyrite, Tetrahedrite, Linnæite, Cinnabar, Barite, Fluorite.
n.	*Cl.* I perfect	ZnS (impurities Fe and Cd)	G. 4. BB fusible with difficulty. *A.* Arsenopyrite, Chalcopyrite, Magnetopyrite, Pyrite, Galenite, Siderite, Barite, Garnet, Pyroxene, Magnetite.
im. acic., scaly. nasv., reni- n.	*Cl.* i ĭ nearly perfect. *Fr.* thin stalky, scaly.	FeO.OH	G. 4. Opaque. Gives off water and is converted to sesquioxide in closed tube. Surface of mass botryoidal. BB infusible. Reactions for iron. *A.* Limonite, Hematite, Specularite.
hort colum., k tab., ntery, acic. nasv., intsp.	*Cl.* i ĭ perfect. *Fr.* thin stalky.	$(Fe,Mn)WO_4$	G. ± 7.2. BB fuses easily to magnetic button, which has a crystalline surface. With mercsm. salt, reddish yellow glass while hot. On *ch.* with tin on cooling green, which becomes reddish yellow in continued R.F. *A.* Arsenopyrite, Molybdenite, Cassiterite, Bismuth, Fluorite, Apatite.
stalline. eniform, ular, masv., p., powdery.	*Fr.* fibr., stalky, earthy, shelly, compact.	$Fe_4O_3(OH)_6$	G. 4. Often tarnished black. (BB, *A.*, etc., see GÖTHITE, II. 2.)

NAME.	LUSTRE.	COLOR.	STREAK.	HARD'SS.	TENACITY.
Braunite (Marcellin) (See II. 1)	sub-metallic	black	dark brown	6.25	brittle
Psilomelane† (Hartmanganerz) (See II. 1)	non-metallic to sub-metal.	black	dark brown	6.25	brittle
Polymignite **Rutile**†	metalloid adamantine	black-brown	light brown, partly yellow	6.5	brittle
Cassiterite† (Zinnerz)	metalloid resinous	black-brown	light brown	6.5	brittle

3. Of

Kermesite‡ (Rothspiessglaserz, Rothspiessglanzerz, Antimonblende, Pyrostibite)	adamantine satin like	dark bluish red to cherry-red	dark bluish red	1	sectile
Cinnabar (Zinnober)	adamantine	cochineal-red	scarlet	2.25	sectile
Pyrostilpnite‡ (Feuerblende, Pyrichrotit)	adamantine, on ii pearly	yellowish red to hyacinth-red	auroral red	2.5	sectile to brittle
Erythrite† (Kobaltblüthe)	vitreous ii mother-of-pearl	crimson- and peach-red, sometimes pearl- or green-gray	paler than color, dry powder deep lavender-blue	2.5	sectile to brittle

TAL SYSTEM, ABIT, AND RUCTURE.	CLEAVAGE AND FRACTURE.	CHEMICAL FORMULA.	REMARKS, Sp. Gr., Reactions. *A* = Associated Minerals.
ag.	*Fr.* uneven	$MnMnO_3$	G. 4.7. BB manganese reactions with the fluxes. *A.* Pyrolusite, Psilomelane, Hausmannite, Barite.
rphous	*Fr.* conchoidal	Manganese Manganate	G. 4.
ag. olum., acic. asv., inter- ed.	*Cl.* ii perfect, I distinct. *Fr.* compact.	$TiTiO_4$	G. 4. Opaque. BB infusible. With mercsm. salt a colorless bead, which, in R.F., becomes violet on cooling. *A.* Menaccanite (Titanic iron ore), Titanite, Apatite.
ag. olum., acic., midal. asv., intsp., ded.	*Cl.* ii perfect, I distinct.	$SnSnO_4$	G. 6.8. Opaque. BB infusible. On *ch.* with soda, button of metallic tin and white coat. *A.* Arsenopyrite, Wolframite, Scheelite, Molybdenite, Bismuth, Blende, Fluorite, Apatite, Lepidolite.

l Streak.

apillary. ifted.	*Cl.* 0 distinct. *Fr.* fibr., stellate.	Sb_2S_2O	G. 4.5. Melts in candle flame. Thin leaves, flexible. Closed tube, blackens, and gives first white and then dark-red sublimate. *A.* Antimonite, Berthierite, Cervantite (Antimonoker), Valentinite.
dl., thick short co-, short acic. asv., intsp., ing.	*Cl.* I very perfect. *Fr.* gran., compact, fibrous, earthy.	HgS	G. 9. Sublimes in matrass. Open tube, S fumes and metal. mercury in drops on cold wall of tube. BB volatile. *A.* Hermesite, Mercury, Chalcopyrite, Siderite, Barite.
plintery.	*Cl.* i1 perfect	Ag_3SbS_3	G. 4.25. Melts in candle flame. BB, like Pyrargyrite (see below). A. Pyrargyrite.
plintery, arty, ing.	*Cl.* i1 highly perfect. *Fr.* fibr., thin stalky, earthy.	$Co_3(AsO_4)_2.8H_2O$	G. ± 3. BB *ch.* arsenic odor; borax, cobalt glass. *A.* Smaltite.

NAME.	LUSTRE.	COLOR.	STREAK.	HARD'SS.	TENACITY.
Proustite (Lichtes Roth-gültigerz)	adamantine	cochineal-red auroral red	auroral to scarlet	2.75	sectile to brittle
Pyrargyrite (Dunkles Roth-gültigerz)	metallic adamantine	black, sometimes approaching cochineal-red	cochineal-red cherry-red purple-red	3	sectile to brittle
Chrysocolla (Kieselkupfer) (See II. 2)	resinous or vitreous to earthy	brown to brownish black; when pure, mountain-green to sky-blue	brownish red; when pure, white	3.5	brittle
Zincite† (Rothzinkerz)	sub-adamantine	deep red to orange-yellow	brownish yellow to orange-yellow	4	brittle
Cuprite† (Rothkupfererz)	adamantine sub-metallic	cochineal to dark red	brownish red to blood-red	4	brittle
Sarkinite **Polyarsenite**					
Hauerite‡ (Mangankies)	sub-metallic	dark reddish brown	brownish red	4	brittle
Plumboferrite					
Hematite (Rotheisenerz, Eisenglanz) (See I. 5)	earthy to sub-metallic	dark red to steel-gray	blood-red	5.5	brittle
Turgite					
Columbite (Niobite)	metalloid-adamantine. vitreous	brownish black	brownish red	6	brittle

CRYSTAL SYSTEM, HABIT, AND STRUCTURE.	CLEAVAGE AND FRACTURE.	CHEMICAL FORMULA.	REMARKS. Sp. Gr., Reactions. *A* = Associated Minerals.
Hex. *H.* r'dl., dart-like, acic., colum., thick tab. *S.* masv., intsp., coating.	*Cl.* R, rather distinct. *Fr.* compact.	Ag_3AsS_3	G. 5.42. Melts in candle flame. BB *ch.* odor of SO_2 and As. With soda, silver button. *A.* Argentite, Stephanite, Silver, Arsenic, Smaltite, Chloanthite, Niccolite, Galenite, Barite, Fluorite, Siderite, Pyrite, Marcasite.
Hex. *H.* r'dl., dart-like, acic., colum., thick tab. *S.* masv., intsp., coating.	*Cl.* R, rather distinct	Ag_3SbS_3	G. ± 5.8. Melts in candle flame. BB *ch.* fuses with spirting to globule. Coats coal white. With soda, button of silver. *A.* Same as Proustite, above.
Amorphous	*Fr.* conchoidal, compact, earthy	$CuSiO_3 2H_2O$	G. 2.1. In closed tube yields water. BB decrepitates and colors flame green. With fluxes, reaction for copper. Infusible. *A.* Malachite, etc.
Hex. *H.* hemimorphic. *S.* masv., intsp.	*Cl.* **0** eminent, ii sometimes. *Fr.* coarse gran., thick shelly.	$(Zn,Mn)O$	G. ± 5.5. Heated in closed tube, blackens, but resumes color on cooling. BB infusible. With fluxes on plat. wire, Mn reaction. R.F. coat of ZnO, yellow hot, white on cooling. Soluble in acids without effervescence. *A.* Franklinite, Calcite, Willemite.
Isom. *H.* octdl., hxdl., dodecl., capil. *S.* masv., interspersed.	*Cl.* 1 distinct	Cu_2O	G. ± 6. BB colors flame green; moistened with HCl, blue. With difficulty fusible. *A.* Malachite, Copper, Limonite.
Isom *H.* octdl.	*Cl.* cubic, distinct	MnS_2	G. 3.4. Closed tube, subl. of S. Open tube, emits S fumes and becomes green. BB infusible. Mn reaction with fluxes. *A.* Sulphur, Gypsum, Tetradymite.
Hex. *H.* r'dl.	*Fr.* compact, fibr., stalky, round gran., earthy	Fe_2O_3	G. ± 5. BB infusible. *Ch.* R.F. becomes magnetic. *A.* Limonite, Göthite, Pyrolusite, Psilomelane.
O'rhm. *H.* thick tab., acic., short columnar.	*Cl.* i–ī distinct	$Fe((Nb,Ta)O_3)_2$	G. 6. BB infusible. *A.* Beryl, in granite.

4. Of

NAME.	LUSTRE.	COLOR.	STREAK.	HARD'SS.	TENACITY.
Chloropal (Pinguite, Gramenite, Nontronite very similar)	resinous	liver-brown	liver-brown	1	malleable to sectile
Torbernite‡ (Kupferuranit, Uranglimmer in part)	**0** pearly, otherwise vitreous	emerald-green	pale green apple-green	2	brittle to sectile
Iodyrite (Iodsilber)	adamantine to resinous	sulphur-yellow	light yellow	2	malleable to sectile
Humboldtine‡ (Oxalite)	lustreless to glinting	ochre-yellow to straw-yellow	straw-yellow	2	sectile
Copiapite‡ (Misy)	earthy to glinting	sulphur-yellow	light yellow	2	sectile
Realgar†	resinous to adamantine	auroral red	orange-yellow	2	sectile to brittle
Orpiment†	pearly on cleavage surfaces, elsewhere resinous	lemon-yellow	lemon-yellow	2	sectile

Yellow Streak.

CRYSTAL SYSTEM, HABIT, AND STRUCTURE.	CLEAVAGE AND FRACTURE.	CHEMICAL FORMULA.	REMARKS. Sp. Gr., Reactions. *A* = Associated Minerals.
Amorphous. *S.* massive.	*Fr.* compact	$(Fe,Al)_2(SiO_3)_3.5H_2O$ (Nontronite— $Fe_2(SiO_3)_3.5H_2O$)	G. 1.75. Greasy to touch. *A.* Barite.
Tetrag. *H.* scaly, tab., pyr. *S.* coating.	*Cl.* **0** perfect I distinct	$(UO_2)_2Cu(PO_4)_2.8H_2O$	G. 3.5. In closed tube yields water. In forceps fuses to blackish mass and colors flame green. With mercsm. salt fuses to green bead, and with tin on coal cools to opaque red. *A.* Uraninite, Limonite, Hematite.
Hex. *H.* hemimorphic, thin tab., short prsm. *S.* coating, lamel., intersp.	*Cl.* **0** perfect. *Fr.* scaly.	AgI	G. 5.6. Crystals small and rare. Melts in candle flame. *A.* Chlorargyrite, Silver.
Crystalline. *H.* capillary. *S.* massive, coating.	*Fr.* compact, earthy	$(FeC_2O_4)_2.3H_2O$	G. ± 2.2. BB infusible. Closed tube, turns black, loses water, and becomes magnetic. *A.* Gypsum, Alum, Lignite.
Mcl. *H.* scaly. *S.* massive, coating.	*Cl.* perfect in one direction. *Fr.* scaly, earthy.	$(FeOH)_2Fe_2(SO_4)_5.$ $18H_2O$	G. 2.1. Insoluble in water. BB yields water, and at higher temp. sulphuric acid. On *ch.* becomes magnetic. *A.* Pyrite, of which it is a product of decomposition.
Mcl. *H.* short prsm., thick tab., short acic. *S.* masv., intsp., coating.	*Cl.* ii **0** rather perfect. *Fr.* compact, earthy.	As_2S_2	G. 3.4–3.6. Melts in candle flame. Combustible. BB burns with blue flame and arsenic odor. In closed tube, red sublimate. *A.* Arsenic, Antimonite, Pyrite, Orpiment, Barite, Calcite.
O'rhm. *H.* short colmn., lenticular. *S.* masv., intsp., lamel., rounded.	*Cl.* ii perfect. *Fr.* short stellate, scaly, gran., compact.	As_2S_3	G. 3.48. In closed tube yellow sublimate, otherwise like Realgar. *A.* Antimonite, Pyrite, Barite, Calcite, Clay.

NAME.	LUSTRE.	COLOR.	STREAK.	HARD'SS.	TENACITY.
Sulphur	resinous to adamantine	sulphur-yellow to gray-brown and red	sulphur- to straw-yellow	2	brittle to sectile
Autunite† (Kalkuranit, Uranit)	**0** pearly, otherwise sub-adamantine	citron- to sulphur-yellow	yellowish	2	sectile
Minium (Mennige)	faint greasy or dull	bright red	orange-yellow	2.5	.....
Xanthoconite‡	adamantine to pearly	orange-yellow	orange-yellow	2.5	sectile to brittle
Xanthosiderite					
Crocoite‡ (Rothbleierz, Kallochrom)	vitreous to adamantine	hyacinth to auroral red	orange-yellow	2.75	sectile
Gummite‡ (Gummierz, Uranogummit, Urangummierz)	greasy	reddish yellow, reddish brown	lemon- to orange-yellow	2.75	sectile to brittle
Pharmacosiderite† (Würfelerz)	vitreous	olive-green to yellowish brown	yellow	2.75	rather sectile
Volborthite (Kalkvolborthite)	mother-of-pearl on **0**, otherwise non-metallic	siskin-green	sulphur-yellow to siskin-yellow	3	.....
Pitticite‡ (Arseneisensinter)	vitreous to greasy	yellowish and reddish brown	ochre-yellow	3	brittle

CRYSTAL SYSTEM, HABIT, AND STRUCTURE.	CLEAVAGE AND FRACTURE.	CHEMICAL FORMULA.	REMARKS. Sp. Gr., Reactions. *A* = Associated Minerals.
O'rhm. *H.* pyramidal. *S.* masv., intsp., powdery, lamellar, rounded.	*Cl.* I distinct 1 distinct. *Fr.* compact, earthy, fibrous.	S	G. 2.072. BB burns with a blue flame. Melts in candle flame. Sublimes. *A.* Gypsum, Calcite, Coal, Galenite, Celestine.
O'rhm. *H.* scaly, thin tab.	*Cl.* **0** eminent I perfect	$(UO_2)_2Ca(PO_4)_2.8H_2O$	G. ± 3.12. Crystals seem tetragonal. In closed tube yields water. BB fuses at 2.5 to a blackened mass. *A.* Uraninite.
(?) *S.* powdery	.....	Pb_3O_4	G. 4.6. BB *ch.* in R.F., button of metallic lead. *A.* Galenite, Calamine, Cerussite.
Hex. *H.* r'dl., tab. *S.* interspersed, spherical.	*Cl.* in one direction	Ag_3AsS_4	G. 5.1. Melts in candle flame. In closed tube at gentle heat yellow color is changed to red and restored on cooling. *A.* Proustite, Barite.
Mcl. *H.* short colmn., acic., dart-like.	*Cl.* I tolerably distinct	$PbCrO_4$	G. ± 6. In closed tube, blackens; on coal, is reduced to metallic lead with deflagration. *A.* Galenite, Gold, Vauquelinite.
(?) *S.* masv., intsp., reniform.	*Fr.* conchoidal to uneven	$(Pb,Ca,Ba)SiU_3O_{12}.5H_2O$	G. ± 4.1. BB infusible. *A.* Uraninite.
Isom. *H.* hxhdrl.	*Cl.* **0** distinct	$Fe(FeOH)_3(AsO_4)_3.6H_2O$	G. ± 3. Pyroelectric. BB *ch.*, with soda, magnetic mass. Color of powder changed to reddish brown by sol. of caustic potash. *A.* Arsenopyrite, Scorodite.
(?) *S.* scaly.	*Cl.* perfect in one direction	$(Cu,Ca)(CuOH)VO_4$	G. 3.5. BB infusible. Powder mixed with soda and fused, then boiled with water, acidified with HCl, and boiled down, becomes emerald-green; diluted with water, sky blue. *A.* Pyrolusite, Sandstone.
Amorphous. *S.* massive, rounded.	*Fr.* conchoidal	$Fe_{20}(OH)_{24}(SO_4)_3((As,P)O_4)_{10}.9H_2O$	G. 2.3. Often crackled. Fragile. (BB, see PHARMACOSIDERITE, above.) *A.* Arsenopyrite.

NAME.	LUSTRE.	COLOR.	STREAK.	HARD'SS.	TENACITY.
Vanadinite	greasy	yellow-brown	light yellow	3	brittle
Endlichite					
Diadochite‡ (Phosphoreisen-sinter)	resinous to vitreous	yellow to yellow-brown	pale yellowish	3	brittle
Castanite					
Greenockite†	adamantine to greasy	honey-yellow to orange	orange-yellow	3	brittle
Hisingerite					
Jarosite‡ (Gelbeisenerz)	vitreous, almost to mother-of-pearl	brown	ochre-yellow	3.5	brittle
Cacoxenite‡	silky	ochre- to lemon-yellow (stains brown)	straw-yellow	3.5	brittle
Pucherite	adamantine	reddish brown brownish red	ochre-yellow	4	brittle
Sphalerite, Zinc Blende, or **Blende**	adamantine	brown to reddish brown	straw-yellow, Isabella-yellow, partly brownish	4	brittle
Wurtzite (Strahlenblende)	adamantine to mother-of-pearl	brown	brownish yellow	4	brittle

CRYSTAL SYSTEM, HABIT, AND STRUCTURE.	CLEAVAGE AND FRACTURE.	CHEMICAL FORMULA.	REMARKS. Sp. Gr., Reactions. *A* = Associated Minerals.
Hex. *H.* short colmn., short acic.	.....	$Pb_5Cl(VO_4)_3$	G. 6.75. BB fuses easily to lustrous mass. *A.* Galenite; on limestone.
Mcl. *S.* reniform or stalactitic, scaly.	*Fr.* conchoidal	$Fe_4O(OH)_2(PO_4)_2(HSO_4)_2$	G. 2. BB yields much water in closed tube. Swells up and becomes opaque-yellow. In forceps swells up and falls to powder. Carefully heated, fuses to gray-black slag. Fragile. *A.* Alum slate.
Hex. *H.* r'dl., pyr., tab. *S.* small reniform, coating, powdery.	*Cl.* I distinct 0 imperf.	CdS	G. 4.8. Nearly transparent. Strong double refraction. Veined parallel to axis. BB gives SO_2 on coal and brown-red coat. Closed tube, carmine color, fading to original color on cooling. Infus. *A.* Galenite, Blende, Prehnite, Calcite.
Hex. *H.* tabular. *S.* massive.	*Cl.* 0 distinct. *Fr.* scaly.	$(FeO)_3K(SO_4)_2.3H_2O$	G. 3.25. BB intumesces, and in R.F. fuses to magnet. button. Powder turned brownish red by solution of potash. *A.* Hematite, Limonite.
Mcl. or Trcl. *H.* capillary. *S.* massive.	*Fr.* short fibr.	$(Fe_2(OH)_3PO_4)_2.9H_2O$	G. $\pm$ 3.4. BB closed tube yields water. Fusible on edges to black slag. Colors outer flame bluish green. *A.* Limonite, Dufrenite.
O'rhm. *H.* tab., short acic.	*Cl.* I distinct	$BiVO_4$	G. 5.9. BB *ch.*, fused with S and KI, red sublimate. With mercsm. salt in R.F., green bead. *A.* Bismite.
Isom. *H.* octdl., tetrdl., dodecl. *S.* masv., intsp., reniform.	*Cl.* I. *Fr* gran., thin stalky, shelly, fibr., compact.	ZnS (contains often Fe and Cd, Cu, Sb, and Mn)	G. 4. Very hard to fuse. BB, open tube. SO_2. On coal, coating of Zn and sometimes of Cd. *A.* Galenite, Chalcopyrite, Pyrite, Arsenopyrite, Siderite, Barite, Fluorite.
Hex. *H.* r'dl., tab. *S.* massive, rounded.	*Cl.* I distinct 0 less so. *Fr.* fibrous.	(Zn,Fe)S	G. 4. (BB. see SPHALERITE.) *A.* Blende, Galenite, Siderite.

NAME.	LUSTRE.	COLOR.	STREAK.	HARD'SS.	TENACITY.
Zincite† (Rothzinkerz)	sub-adamantine	orange-yellow	orange-yellow	4	brittle
Bastnäsite					
Parisite					
Triplite	resinous	brown-black	pale yellow gray-yellow	4.5	brittle
Göthite (Nadeleisenerz)	adamantine velvety silky	brown	brownish yellow	4.5	brittle
Herderite					
Hatchettolite					
Durangite					
Limonite	greasy to vitreous, also silky	brown-yellow	brown-yellow to ochre-yellow	5.5	brittle
Microlite					
Basaltic Hornblende‡	vitreous	brown-black to pitch-black	Isabella-yellow to ochre-yellow	5.5	brittle
Rutile (See II. 2)	metalloid adamantine	black-brown	light yellow	6.5	brittle
Cassiterite (Zinnerz)	adamantine, slightly metallic	brown to black	Isabella-yellow	6.5	brittle
Ferruginous Quartz	vitreous	ochre-yellow to brown	light ochre-yellow	7	brittle

CRYSTAL SYSTEM, HABIT, AND STRUCTURE.	CLEAVAGE AND FRACTURE.	CHEMICAL FORMULA.	REMARKS. Sp. Gr., Reactions, *A* = Associated Minerals.
Hex. *H.* hemimrph. *S.* masv., interspersed.	*Cl.* **0** eminent I sometimes. *Fr.* coarse gran., thick shelly.	(Zn,Mn)O	G. ± 5.5. BB infusible. *A.* Franklinite, Calcite, Willemite.
Mcl. *S.* massive.	*Cl.* distinct in two directions. *Fr.* thick shelly.	$(Fe,Mn)PO_4(Fe,Mn)F$	G. 4. Fuses easily to black magnetic globule. With H_2SO_4 evolves F. Soluble in HCl. *A.* Apatite, Beryl. In granite.
O'rhm. *H.* acic., scaly, capillary. *S.* massive, rounded.	*Cl.* ii perfect. *Fr.* fibrous, stalky, scaly.	FeO.OH	G. 4. BB iron reactions. *A.* Limonite.
Crystalline. *S.* masv., interspersed, reniform, rounded, powdery.	*Fr.* stalky, fibr., earthy, shelly, compact	$Fe_4O_3(OH)_6$	G. ± 3.7. BB iron reactions. *A.* Hematite, Pyrolusite, Psilomelane, Barite, Chalcedony.
Mcl. *H.* prsm., acic. *S.* masv., intsp.	*Cl.* I highly perfect. *Fr.* compact, stalky.	$(Mg,Fe)_3Al_2(AlO_3)_2(SiO_3)_3$	G. ± 3.1. Unacted on by acids. *A.* Augite in Basalt, Phonolite, etc.
Tetrag. *H.* pyr., colmn., acic. *S.* masv., intsp.	*Cl.* ii perfect I distinct. *Fr.* thick gran.	$TiTiO_4$	G. 4. (BB, see II. 2.)
Tetrag. *H.* colmn., acic., pyr. *S.* masv., intsp.	*Cl.* ii perfect I distinct. *Fr.* compact, fibrous, gran.	$SnSnO_4$	G. ± 6.8. Opaque. BB infusible. Coal with soda metallic tin. *A.* Arsenopyrite, Wolframite, Molybdenite, Bismuth, Fluorite, Apatite, Scheelite, Lepidolite, Blende, Chalcopyrite, Pyroxene, Amphibole.
Hex. *H.* colmn., acic. *S.* masv., intsp.	*Fr.* compact, gran., stalky	SiO_2 (with yellow or red oxide of iron)	G. 2.7. BB infusible. Borax dissolves slowly to clear glass-green when hot. Melts with soda with intumescence. *A.* Limonite.

5. Of

NAME.	LUSTRE.	COLOR.	STREAK.	HARD'SS.	TENACITY.
Chloropal‡ (Pinguite, Nontronite very similar)	waxy	finch-green	yellowish green to finch-green	1	sectile to malleable
Bromargyrite (Bromsilber, Embolite, Chlorbromsilber)	adamantine	green yellow	yellowish to siskin green	1.5	malleable
Ehlite‡ (Prasin in part)	common, mother-of-pearl	emerald-green	pale green	2	sectile to brittle
Torbernite† (Kupferuranit) (See II. 4)	common on **0**, mother-of-pearl	emerald-green, verdigris-green, apple-green	pale green apple-green	2	brittle to sectile
Genthite‡ (Nickel Sepiolith)	feebly resinous to lustreless	apple-green to emerald-green	pale green apple-green	2	sectile
Glauconite					
Annabergite† (Nickelblüthe)	glinting to lustreless	apple-green	pale green apple-green	2.25	sectile to brittle
Clinochlore					
Garnierite‡ (Numäit)	glinting to lustreless	apple-green	pale green	2.5	brittle

Green Streak.

CRYSTAL SYSTEM, HABIT, AND STRUCTURE.	CLEAVAGE AND FRACTURE.	CHEMICAL FORMULA.	REMARKS. Sp. Gr., Reactions. *A* = Associated Minerals.
Amorphous. *S.* massive.	*Fr.* on large surfaces conchoidal to uneven, on small surfaces splintery, earthy	$(Fe,Al)_2(SiO_3)_3.5H_2O$	G. ± 1.8. Greasy feel. Closed tube yields water. BB infusible, turns black, and becomes magnetic. Completely decomp. by HCl with separation of pulverulent SiO_2. *A.* Barite.
Isom. *H.* hexdl, octdl. *S.* massive, lamel., coating.	*Fr.* massive, splintery	Ag Br	G. 5.9. Often gray tarnish. Melts in candle flame. In closed tube fuses without decomp. Placed on strip of zinc and moistened swells up, turns black, and is reduced to metallic Ag. which gives lustre on pressure with knife-blade. *A.* Native Silver, Calcite.
Crystalline. *H.* scaly. *S.* masv., intsp., reniform, warty.	*Cl.* perfect in one direction. *Fr.* scaly, radial.	$Cu(CuOH)_4(PO_4)_2H_2O$	G. 4. In matrass gives water and turns black. Heated rapidly decrepit. BB *ch.* long heated fuses to button with nucleus of Cu. *A.* Pseudomalachite.
Tetrag. *H.* scaly, tab., pyramidal.	*Cl.* 0 perfect i distinct	$(UO_2)_2Cu(PO_4)_2.8H_2O$	G. ± 3.5. In closed tube yields water. In forceps fuses to black mass and colors flame green. *A.* Uraninite, Limonite, Hematite.
Amorphous. *S.* coating.	*Fr.* conchoidal	$(Mg,Ni)_2H_4Si_2O_{10}$	G. 2.4. Sometimes so soft as to be polished by the nail and fall to pieces in water. Closed tube, blackens and gives water. BB almost infusible. *A.* Chromite, Serpentine.
Mcl. *H.* capillary. *S.* masv., intsp., coating.	*Fr.* compact, earthy	$(Ni_3(AsO_4)_2.8H_2O$	G. 3. BB fuses easily, with arsenic odor, and yields metallic button, which with borax gives first blue cobalt glass, and later violet to reddish brown of Ni. *A.* Chloanthite, Niccolite, Gersdorffite, Siderite, Barite.
Amorphous	*Fr.* massive	$(Ni,Mg)H_2SiO_4$	G. 2.27. Adheres to tongue. In matrass gives water, becoming gray. With borax, nickel bead. Immersion in water, decrepitates, the fragments having conchoidal fracture. *A.* Chromite, Serpentine, Steatite.

NAME.	LUSTRE.	COLOR.	STREAK.	HARD'SS.	TENACITY.
Ripidolite† (Chlorite Group)	of cleavage face somewhat pearly	deep grass-green to olive-green	gray-green to uncolored	2.5	sectile
Cronstedtite‡ (Chamosit)	vitreous	coal-black to brownish black	dark olive green	2.5	brittle
Tyrolite‡ (Kupferschaum)	0 pearly	bluish green	bluish, verdigris-green	2.5	sectile
Chalcophyllite‡ (Kupferglimmer)	0 pearly	emerald- to verdigris-green	pale green	2.5	brittle
Connarite					
Clinoclasite‡ (Strahlerz)	0 pearly	bluish green to greenish black, on surface nearly black	bluish green	2.75	sectile to brittle
Liroconite‡ (Linsenerz)	vitreous to greasy	bluish green	bluish green	2.75	brittle to sectile
Astrophyllite					
Euchroite‡	vitreous	emerald-green	bluish green	3	brittle
Dufrenite† (Kraurite, Grüneisenerz)	vitreous to greasy, on ii pearly	dark leek-green to greenish black	yellowish green siskin-green	3.25	very brittle

CRYSTAL SYSTEM, HABIT, AND STRUCTURE.	CLEAVAGE AND FRACTURE.	CHEMICAL FORMULA.	REMARKS. Sp. Gr., Reactions. *A* = Associated Minerals.
Mcl. *H.* tab., foliaceous, scaly. *S.* masv., intsp., reniform, coating.	*Cl.* **0** eminent. *Fr.* scaly, compact, earthy.	$Al_2(Fe,Mg)_5H_9Si_3O_{20}$	G. ± 2.7 Crystals seem hex. BB yields water. In platinum forceps whitens, and fuses with difficulty on edges. Partially gelatinizes with acids. *A.* Talc, Dolomite, Magnetite.
Hex. *H.* r'drl., colmn., fibr. *S.* masv., reniform, cylindrl.	*Cl.* **0** highly perfect	$Fe_2(Fe,Mg)_3H_6Si_2O_{13}$	G. ± 3.3. BB froths and fuses on edges. Gelatinizes in concen. HCl. *A.* Limonite, Calcite.
(?) *H.* foliaceous, scaly. *S.* massive.	*Cl.* perfect in one direction. *Fr.* scaly, radial.	$Cu(CuOH)_4(AsO_4)_2 \cdot 7H_2O$	G. 3. In closed tube decrepitates and yields much water. *Ch.* fuses with arsenic odor. R.F. globules of copper. *A.* Tetrahedrite, Malachite, Azurite.
Hex. *H.* r'drl., scaly, foliaceous, thin tab.	*Cl.* **0** highly perfect	$(Cu(OH)_2(CuOH)_3AsO_4)_2 7H_2O$	G. ± 2.5. In closed tube decrepitates and yields much water. Soluble in ammonia. *A.* Chalcopyrite, Cuprite.
Mcl. *H.* short acic., short colmn., thick tab., chisel-shaped. *S.* rounded.	*Cl.* **0** perfect crumpled, foliaceous. *Fr.* radial.	$(CuOH_2)AsO_4$	G. ± 4.2. In closed tube gives water. BB fuses, coloring flame bluish green. *Ch.* with soda, button of copper. Soluble in ammonia. *A.* Chalcopyrite.
Mcl. *H.* short colmn., blunt pyram., lenticular.	.....	$(Al_4Cu_9(OH)_{15}(AsO_4)_5 \cdot 20H_2O$	G. 2.8. In closed tube gives much water and turns green. BB cracks open, but does not decrepitate. Sol. in ammonia. *A.* Chalcopyrite.
O'rhm. *H.* thick tab., short columnar.	*Cl.* I rather distinct	$(CuOH)CuAsO_4 3H_2O$	G. ± 3.4. In closed tube gives water. (For other reactions, see OLIVENITE.) *A.* Olivenite, Asbolite.
O'rhm. *H.* cuboid. *S.* reniform.	*Cl.* ii perfect. *Fr.* radial.	$Fe_2(OH)_3PO_4$	G. ± 3.3. In closed tube gives water. BB fuses easily to slag. Crystals rare and small. *A.* Limonite, Cacoxenite.

NAME.	LUSTRE.	COLOR.	STREAK.	HARD'SS.	TENACITY.
Zaratite† (Emerald Nickel, Nickel Smaragd)	vitreous	emerald-green	paler green	3.25	brittle
Chrysocolla (Kieselkupfererz)	vitreous, unctuous to lustreless	green	bluish green	3.5	brittle
Libethenite† (Prasin)	greasy to vitreous	leek-green to blackish green	olive-green to bright green	3.5	brittle
Celadonite					
Olivenite† (Pharmakochalzit)	vitreous unctuous silky	leek-green olive-green pistachio-green	olive-green	3.5	brittle
Malachite	vitreous, pearly, and silky	emerald-green, on greenish black	emerald- to verdigris-green	3.5	brittle
Brochantite‡	vitreous	emerald-green	emerald- to verdigris-green	3.5	brittle
Alabandite‡ (Manganblende)	sub-metallic	iron-black	dark green to gray	3.75	brittle to sectile
Atacamite‡ (Halochalzit)	vitreous to unctuous	emerald- to leek-green	emerald- to light verdigris-green	3.75	brittle
Mixite					

CRYSTAL SYSTEM, HABIT, AND STRUCTURE	CLEAVAGE AND FRACTURE.	CHEMICAL FORMULA.	REMARKS. Sp. Gr., Reactions. *A* = Associated Minerals.
(?)	.....	$2Ni(OH)_2NiCO_3.4H_2O$	G. 2.57. Stalactitic. Minute mammillary. In closed tube yields water and CO_2. BB infusible. Borax O.F. violet bead hot, and reddish brown cold. R.F. green, opaque. *A.* Chromite, Serpentine.
Amorphous	*Fr.* conchoidal to irregular	$CuSiO_3.2H_2O$	G. 2.1. (See II. 2, 3.)
O'rhm. *H.* pyramidal.	.....	$(CuOH)CuPO_4$	G. 3.7. In closed tube yields water and turns black. BB fuses, colors flame green, and R.F. with soda yields metallic copper. *A.* Malachite, Cuprite, Limonite.
O'rhm. *H.* short acic., short colmn., capillary. *S.* masv., reniform.	*Fr.* fibrous	$(CuOH)CuAsO_4$	G. ± 4.3. In closed tube gives water. BB fuses, coloring flame bluish green, and on cooling fused mass is crystalline. *Ch.* with soda, copper. Soluble in ammonia. *A.* Chalcopyrite, Asbolite, Enargite.
Mcl. *H.* capil., acic. *S.* masv., intsp., reniform, powdery, coating.	*Cl.* **0** perfect ii less so. *Fr.* fibr., compact, earthy, scaly, shelly.	$(CuOH)_2CO_3$	G. ± 3.8. In closed tube blackens and yields water. BB fuses, coloring flame emerald-green. *Ch.* in R.F., reduced to copper. Effervesces with acids. *A.* Chalcopyrite, Tetrahedrite, Chalcosite, Cuprite, Copper, Limonite, Hematite, Azurite.
O'rhm. *H.* short acic. *S.* reniform.	*Cl.* ii very perfect. *Fr.* fibrous.	$2Cu(OH)_2(CuOH)_2SO_4$	G. ± 3.8. Crystals small. In matrass yields water and turns blackish brown. Soluble in NH_4O. BB, mixed with *ch.*, powder gives SO_2. Melts on coal in R.F., yielding button of Cu. *A.* Chalcopyrite, Malachite, Limonite.
Isom. *H.* octahedra.. *S.* masv., intsp.	*Cl.* **0** perfect. *Fr.* compact.	MnS	G. ± 4. Opaque. Surface dull and dark brown. BB fuses with much difficulty. Unchanged in closed tube. With fluxes, reaction for Mn. Soluble in HNO_3 with evolution of H_2S. *A.* Blende, Rhodochrosite.
O'rhm. *H.* acic., prsm., thick tab. *S.* masv., intsp., powdery.	*Cl.* ii distinct **0** distinguishable. *Fr.* radial.	$Cu^{\prime}OH)_2Cu(OH)Cl$	G. 4.1. In closed tube gives off water. BB azure-blue flame. *Ch.* with soda, metallic Cu. Soluble in ammonia. *A.* Limonite, Hematite.

NAME.	LUSTRE.	COLOR.	STREAK.	HARD'SS.	TENACITY.
Dioptase† (Kupfersmaragd)	vitreous	emerald-green	verdigris-green to sky-blue	4.75	brittle
Pseudo-Malachite† (Phosphor-chalcit)	greasy to vitreous	blackish green, emerald-green, verdigris-green	emerald- to verdigris-green	5	brittle
Yttrotantalite					
Pyroxene (Augite)	vitreous	blackish green, greenish black	grayish green	5.5	brittle
Hornblende† (Amphibole)	vitreous, in part pearly	blackish green to velvet-black	grayish green	5.5	brittle
Lievrite (Ilvaite)	unctuous	black	dark green	5.75	brittle
Spinel (Var. Pleonast)	vitreous to greasy	black to green	grayish green	7.5	brittle

6. Of

Tyrolite‡ (Kupferschaum)	pearly	sky-blue to verdigris-green	greenish blue	2.5	sectile
Vivianite† (Blaueisenerz)	ii metallic pearly, other faces vitreous	indigo-blue to blackish green	light indigo-blue	2.5	sectile

CRYSTAL SYSTEM, HABIT, AND STRUCTURE.	CLEAVAGE AND FRACTURE.	CHEMICAL FORMULA.	REMARKS. Sp. Gr., Reactions. A = Associated Minerals.
Hex. *H.* r'drl., short columnar. *S.* interspersed.	*Cl.* R perfect. *Fr.* compact.	CuH_2SiO_4	G. ± 3.2. In closed tube blackens and yields water. BB blackens without fusing, and colors flame emerald-green. Gelatinizes with acids. *A.* Calcite.
(?) *H.* short colmn. *S.* masv., intsp.	*Fr.* compact, fibrous	$(Cu.OH)_2PO_4$	G. ± 4.2. In closed tube yields water and turns black. BB fuses, colors flame green, and with soda on coal gives metallic copper. Sparingly soluble in ammonia. *A.* Malachite.
Mcl. *H.* short colmn., thick tab. *S.* masv., intsp.	*Cl.* I distinct I∧I 87°. *Fr.* granular.	$Mg,Ca(SiO_3)_2$	G. 3.3. *A.* Amphibole, Garnet, Calcite, Magnetite, Pyrite, Blende, Galenite.
Mcl. *H.* short colmn., short acic. *S.* masv., intsp.	*Cl.* I perfect i∧i 124°. *Fr.* fibr., stalky, granular.	$(Mg,Fe)_3Ca(SiO_3)_4$	G. ± 3.1. *A.* Pyroxene, and same as preceding.
O'rhm. *H.* colmn., acic. *S.* intsp., masv.	*Cl.* i–ĭ distinct. *Fr.* fibrous, stalky.	$(FeOH)Fe_2Ca(SiO_4)_2$	G. 3.9. BB fuses to black magnetic bead. Gelatinizes with HCl. *A.* Pyroxene.
Isom. *H.* octahedral. *S.* intsp., masv.	*Fr.* compact, conchoidal.	$(Mg,Fe)((Al,Fe)O_2)_2$	G. ± 4.2. Opaque. BB infusible. *A.* Magnetite, Calcite, in basalt.

Blue Streak.

(?) *H.* foliaceous, scaly. *S.* massive.	*Cl.* perfect in one direction. *Fr.* scaly, radial.	$(CuOH)_4Cu(AsO_4)_2 + 7H_2O$	G. 3. In closed tube decrepitates and yields much water. *Ch.* fuses with As odor. R.F. with soda, button of copper. Sol. in HCl with effervescence. *A.* Tetrahedrite.
Mcl. *H.* acic., scaly. *S.* masv., intsp., powdery.	*Cl.* i͡i highly perfect. *Fr.* radial, earthy.	$Fe_3(PO_4)_2.8H_2O$	G ± 2.5. In closed tube yields neutral water, whitens and exfoliates. BB fuses, coloring flame bluish green to gray; black metallic globule. *A.* Limonite, Pyrite, Magnetopyrite, Clay, Peat.

NAME.	LUSTRE.	COLOR.	STREAK.	HARD'SS.	TENACITY.
Herrengrundite (Urvölgyite)‡	pearly	emerald-green	sky-blue	2.75	brittle
Liroconite‡ (Linsenerz)	vitreous to greasy	sky-blue to verdigris-green	greenish blue	2.75	brittle to sectile
Linarite‡ (Bleilasur)	adamantine to vitreous	deep azure-blue	pale blue	2.75	brittle
Azurite† (Kupferlasur)	vitreous or adamantine	azure-blue blackish blue smalt-blue	smalt-blue	3.75	brittle
Chrysocolla	vitreous, unctuous to lustreless	sky-blue	smalt-blue	3.5	brittle
Dioptase† (Kupfersmaragd)	vitreous	emerald-green	sky-blue to verdigris-green	4.75	brittle
Lapis Lazuli† (Lasurstein, Lasurite)	greasy to vitreous	azure-blue	smalt-blue to pale blue	5.5	brittle

CRYSTAL SYSTEM, HABIT, AND STRUCTURE.	CLEAVAGE AND FRACTURE.	CHEMICAL FORMULA.	REMARKS. Sp. Gr., Reactions. *A* = Associated Minerals.
Mcl. *H.* foliaceous. *S.* massive.	*Cl.* 0 perfect. *Fr.* shelly, scaly.	$Ca(OH)_2(CuOH)_2 2SO_4.3H_2O$	G. 3.1. *A.* Gypsum.
Mcl. *H.* short colmn., blunt pyram., lenticular.	.....	$Al_4Cu_2(OH)_{15}(AsO_4)_5.20H_2O$. Part of P replaced by As.	G. 2.8. In closed tube yields much water and turns green. BB cracks open but does not decrepitate. Soluble in NH_5O. *A.* Tetrahedrite.
Mcl. *H.* acic., tab.	*Cl.* i–ī very perfect 1–ī dist.	$((Pb,Cu)OH)_2SO_4$	G. ± 5.4. In closed tube yields water and loses color. BB fuses easily to a pearl, and in R.F. yields metallic button, which coats *ch.* with PbO. On fusing this with boric acid Cu is obtained. With soda, hepar reaction. Decomposed by HNO_3, leaving white $PbSO_4$. *A.* Chalcopyrite, Galenite, Cerussite.
Mcl. *H.* thick tab., thin tab., acic. *S.* masv., intsp., rounded, coating, powdery.	*Cl.* 2–ī rather perfect ī–i less distinct. *Fr.* radial, compact, earthy.	$(Cu.OH)_2Cu(CO_3)_2$	G. ± 3.7. BB, see MALACHITE, II. 5.
Amorphous	*Fr.* conchoidal to uneven	$CuSiO_3.2H_2O$	G. ± 2.1. (See II. 2.) Decomposed by acids without gelatinizing.
Hex.	*Cl.* R perfect	CuH_2SiO_4	G. ± 3.2. (See II. 5.)
Isom. *H.* dodecdrl. *S.* masv., intsp.	*Fr.* massive, fine-granular	$(Na_2,Ca)AlSiO_4$ (?)	G. ± 2.3. Crystals very rare. In closed tube gives off water, and that from Chili glows with beetle-green light, but color remains blue. Fuses with intumescence to white glass, decomp. by HCl, with separation of gelatinous SiO_2 and evolution of H_2S. *A.* Pyrite, Calcite. *Never Quartz.*

III. MINERALS OF NON-

AND OF WHITE OR

1. Very

NAME.	LUSTRE.	COLOR.	HARD'SS.	TENACITY.
Petroleum† (Erdöl, Steinöl)	.....	black, brown, yellow, white	.....	.....
Ozocerite (Mineral wax)	unctuous	brown, yellow	1	malleable waxy
Talc (Steatite)	pearly to greasy	white, light green	1	very sectile to malleable
Roscoelite				
Kaolinite (Porcelain earth, Nacrite allied)	on 0 pearly lustreless	white	1	sectile
Bismite (Wismutocker)				
Aluminite†	glinting to dull earthy	white	1	sectile to malleable
Ulexite (Boronatrocalcit)	silky	white	1	.....

METALLIC LUSTRE

LIGHT GRAY STREAK.

Sectile.

CRYSTAL SYSTEM, HABIT, AND STRUCTURE.	CLEAVAGE AND FRACTURE.	CHEMICAL FORMULA.	REMARKS. Sp. Gr., Reactions. *A* = Associated Minerals.
.....	.....	A mixture of the higher members of the Paraffine series C_nH_{2n+2}	G. 0.6 to 0.75. Liquid, saturating sandstones and other sedimentary rocks. Inflammable. Odorous.
(?)	.....	" " "	G. 1. Solid. Strong smell. Waxy. Sticky. Melts in boiling water. Burns with bright flame. *A.* Clay, sandstone, rock salt.
Mcl. (?) *H.* scaly, foliaceous. *S.* massive.	*Cl.* 0 perfect. *Fr.* thin shelly, scaly, compact, splintery.	$Mg_5H_2Si_4O_{12}$	G. ± 2.7. Very greasy to touch. In closed tube, when intensely heated, most varieties yield water. BB fusible on very thin edges to white enamel. With cobalt solution a pale red color. Not decomp. by acids. *A.* Actinolite, Chlorite, Dolomite, Magnesite, Apatite, Magnetite, Pyrite.
Mcl. *H.* scaly. *S.* massive, coating.	*Cl.* 0 perfect. *Fr.* fine scaly, earthy.	$Al_2H_4Si_2O_9$	G. ± 2.5. Opaque. Nacrite greasy, Kaoline chalky feel. Becomes plastic in water. BB infusible. *A.* Galenite, Blende, Siderite, Lignite, Cassiterite.
Mcl. (?)	*Fr.* earthy	$Al_2(OH)_4SO_4.7H_2O$	G. ± 2.6. In closed tube yields much water, which at high temperature becomes acid. With cobalt solution, fine blue color. With soda, hepar reaction. Soluble in acids. BB. infusible. *A.* Clay, Marl, Gypsum.
(?) *S.* in rounded masses, fibr., acic.	.....	$CaNaB_5O_9.6H_2O$	G. 1.6. *A.* Anhydrite, Gypsum.

NAME.	LUSTRE.	COLOR.	HARD'SS.	TENACITY.
Smectite† (Malthazite, Montmorillonit)	waxy	greenish gray (Montm. rose-red)	1	sectile to malleable
Thermonatrite				
Pyrophyllite‡ (Agalmatolite)	pearly	white, apple-green, yellowish	1.5	sectile
Jefferisite				
Cerargyrite (Hornsilver, Chlorargyrite, Silberhornerz)	resinous to adamantine	gray, gray-green, brown, streak shining	1.5	malleable
Bromyrite (Bromargyrite, Bromsilber)	adamantine splendent	bright yellow to amber, slightly greenish	1.5	sectile
Embolite	" " "	" " "	"	"
Calomel‡ (Quecksilberhornerz)	adamantine	white, gray, brown	1.5	sectile
Sassolite‡ (Boric acid)	on 0 pearly	white, pale yellow	1.5	sectile
Sal Ammoniac† (Salmiak)	greasy to vitreous	white, yellow	1.75	sectile
Soda Nitre† (Chili Nitre, Natronsalpeter)	vitreous	white	1.75	sect. to brittle

CRYSTAL SYSTEM, HABIT, AND STRUCTURE.	CLEAVAGE AND FRACTURE.	CHEMICAL FORMULA	REMARKS. Sp. Gr., Reactions. *A* = Associated Minerals.
Amorphous.	*Fr.* conchoidal to uneven, compact, splintery	$Al_2H_2Si_4O_{12} + x\,H_2O$	G. ± 2. Soapy feel. BB Malthazite is infusible, but Smectite, owing to impurities, fuses easily. Decomposed by HCl.
O'rhm. *H.* scaly. *S.* masv., lamel.	*Cl.* **0** eminent. *Fr.* broad stalky, scaly, compact.	$Al\,H.Si_2O_6$	G. ± 2.8. Very greasy to touch. Yields water. BB whitens and fuses with difficulty on edges. Radial varieties exfoliate and swell up very much. With cobalt solution blue. *A.* Cyanite.
Isom. *H.* hexhdl. *S.* masv., lamel., coating.	*Cl.* none. *Fr.* compact, fibrous.	$AgCl$	G. ± 5.4. Fuses without decrepitation in candle flame. BB on coal, button of metallic silver. In bead of micrcsm. salt, saturated with CuO, gives intensely blue flame. On zinc and moistened with water swells up, turns black, and is reduced to metallic Ag, whose lustre appears on pressing with a knife. Soluble in ammonia. *A.* Native Silver, Calcite, Limonite.
Isom. *H.* hexdl., octdl. *S.* masv., lamel., coating.	*Fr.* compact, fibrous	$AgBr$	G. 5.9. In closed tube and with metal. Zn behaves like Cerargyrite. *A.* Native Silver, Calcite.
" "	" "	Ag_2ClBr	
Tetrag. *H.* pyr., thick tab., short acic. *S.* interspersed, coating.	*Cl.* i–i perfect. *Fr.* compact.	Hg_2Cl_2	G. 6.5. Crystals very small. Sublimes. Volatilizable, giving white sublimate. Blackens with alkalies. *A.* Cinnabar, Mercury.
Trcl. *H.* scaly, capil. *S.* incrusted.	*Cl.* basal very perfect. *Fr.* scaly, fibr.	$(OH)_3B$	G. ± 1.5. Greasy to touch. With difficulty soluble in water. In closed tube gives water. BB fuses on wire to clear bead, and tinges flame yellowish green. *A.* Native Sulphur.
Isom. *H.* trapzhdl., octdl., hexdl. *S.* incrustations and coatings.	*Fr.* fibrous, earthy	NH_4Cl	G. 1.5. Taste astringent. Sublimes in tube. Heated with $Ca(OH)_2$ gives off ammonia. Dissolves readily in water, and solution precipitates HgCl when added to $AgNO_3$ in solution. *A.* Lava, clay, coal.
Hex. *H.* r'dl. *S.* massive.	*Cl.* R perfect. *Fr.* granular.	$NaNO_3$	G. ± 2.1. Taste cooling and bitter. Soluble in water. Deflagrates on coal. Melts in candle flame, which it colors Na yellow. *A.* Halite.

NAME.	LUSTRE.	COLOR.	HARD'SS.	TENACITY.
Mirabilite‡ (Glauber's Salt, Exanthalit)	vitreous	white	1.75	sectile
Tellurite				
Halloysite (Bol. Variety Kaolinite)	resinous	white, yellow, red	2	sect. to brittle
Cotunnite				
Copalite‡ (Retinite, Rhetinit)	resinous	yellow, brown, gray	2	sect. to brittle
Kalinite† (Alum, Potash Alum)	vitreous	white	2	brittle to sectile
Nitre (Saltpeter)	vitreous	white	2	sectile
Chrysotile (Serpentine Asbestus)	metallic, silky	green, brown	2	sect. to brittle
Hydrotalcite				
Gypsum	vitreous, silky, il pearly	white, gray, yellow, red, brown	2	sect. to brittle
Melanterite† (Copperas, Green Stone, Iron Vitriol, Green Vitriol)	vitreous	green, effloresces to white	2	brittle

CRYSTAL SYSTEM, HABIT, AND STRUCTURE.	CLEAVAGE AND FRACTURE.	CHEMICAL FORMULA.	REMARKS, Sp. Gr., Reactions. A = Associated Minerals.
Mcl. *S.* in efflorescent crusts.	*Cl.* i–i perfect	$Na_2SO_4.10H_2O$	G. 1.5. Cooling taste, then saline and bitter. Fuses. Yields much water. Dissolves easily in water, and solution precipitates $BaCl_2$ solution. Colors flame yellow. *A.* Efflorescence Carlsbad and other thermal springs, caverns Hawaii.
Amorphous. *S.* masv., intsp., lamellar.	*Fr.* compact	$Al_2H_4Si_2O_9.xH_2O$	G. 2.5. Infusible. Blue with Co solution. *A.* Basalt, sandstone.
Amorphous. *S.* masv.; intsp., nodular.	*Fr.* compact, earthy	$C_{12}H_{18}O$	G. 1.01. Melts in candle flame. Volatilizes by gentle heat. Burns with yellow flame and much smoke. Emits resinous odor when broken. *A.* Lignite.
Isom. *H.* pentagonal, hmhdrl. *S.* efflorescence.	*Cl.* 1 observable	$KAl(SO_4)_2.12H_2O$	G. 1.75. Soluble in water. Alum taste. BB fuses in its water of crystallization and froths. With Co solution, intense blue, and with soda, hepar reaction. *A.* Lava, coal.
O'rhm. *H.* acic., capil. *S.* flaky, coat'g.	*Cl.* I and ii observable	KNO_3	G. 2. Taste saline and cooling. Deflagrates vividly on burning coals, and detonates with combustibles. Colors flame violet. *A.* Limestone caves.
O'rhm. *S.* lamellar.	*Fr.* fibrous	$(MgFe)_3H_4Si_2O_9$	G. 2.2. Delicately fibrous, the fibres easily separating. *A.* Serpentine.
Mcl. *H.* colmn., acic., tab., scaly, lenticular. *S.* masv., lamellar, powdery.	*Cl.* ī ī perfect ī and īī observbl., 66°. *Fr.* gran., fibr., scaly, earthy, compact.	$CaSO_4.2H_2O$	G. 2.3. Very little soluble in water. Yields water and becomes opaque. BB melts to a button. *A.* Clay, marl, Native Sulphur, also as new formation on metal veins.
Mcl. *H.* capil., acic., columnar. *S.* reniform, masv., lamellar.	*Cl.* 0 observable. *Fr.* compact, fibrous.	$FeSO_4.7H_2O$	G. 1.8. Dissolves in water. Yields water, and becomes brown and finally black and magnetic. With fluxes, reacts for Fe. Taste harsh, astringent, and metallic. *A.* Alunogen, Pyrite.

NAME.	LUSTRE.	COLOR.	HARD'SS.	TENACITY.
Alunogen‡ (Keramohalite, Haarsalz)	silky, pearly	white, partly yellowish	2	sectile
Aurichalcite (Cupreous Hydrozincite, Messingblüthe)	pearly	greenish blue bluish green	2	sectile
Brucite†	O pearly	white	2	sectile
Thomsenolite				
Sulphur	adamantine resinous	yellow, gray, brown	2	brittle to sectile
Struvite				
Trona‡ (Natron, Urao)	vitreous	white	2	sectile
Sepiolite† (Meerschaum)	dull, brightens in streak	white, partly yellowish	2.25	sectile
Borax† (Tinkal)	resinous to vitreous	white, in part gray	2.25	brittle to sectile
Tschermigite‡ (Ammonia Alum)	vitreous	white	2.25	brittle

CRYSTAL SYSTEM, HABIT, AND STRUCTURE.	CLEAVAGE AND FRACTURE.	CHEMICAL FORMULA.	REMARKS. Sp. Gr., Reactions. *A* = Associated Minerals.
(?) *H.* capil., acic., scaly. *S.* reniform, botrydl., lamel., incrustation	*Cl.* perfect in one direction. *Fr.* fibr., scaly, granular.	$Al_2(SO_4)_3.18H_2O$	G. ± 1.7. Taste astringent. Yields water and SO_2 in closed tube. Blue with Co solution. When deprived of water infusible. *A.* Clay, Lignite, Pyrite, Alum, coal.
(?) *H.* acic., scaly. *S.* drusy incrustations, masv.	*Cl.* perfect in one direction. *Fr.* fibr., scaly.	$2(Zn,Cu)(OH)_2.$ $((Zn,Cu)OH)_2CO_3$	G. 3.7. Soluble with effervescence in hydrochloric acid. *A.* Limonite, Chalcopyrite, Zincblende.
Hex. *H.* r'dl., tab. scaly. *S.* massive.	*Cl.* **0** perfect. *Fr.* shelly, stalky, fibr	$Mg(OH)_2$	G. 2.3. Greasy to touch. Yields water, becoming opaque. BB infusible, but vividly incandescent. With Co solution, violet red. Soluble in acids. *A.* Serpentine, limestone, Chromite.
O'rhm. *H.* pyramidal. *S.* masv., lamel., rounded, crustlike, powdery, interspersed.	*Cl.* **0** **1** } observ.	S	G. 2. Melts and ignites in candle flame. (See II. 4.)
Mcl. *H.* colum., fibr. *S.* massive.	*Cl.* i–i perfect	$Na_2NaH(CO_3)_2.2H_2O$	G. 1.4. Soluble in water. Alkaline reaction and taste. Only occurs in powder. Colors flame intensely yellow. *A.* Mirabilite, Halite.
Amorphous. *S.* massive, nodular.	*Fr.* in large masses, conchoidal; in small, earthy, compact	$Mg_2H_4Si_3O_{10}$	G. 0.988–1.279. Can be cut by the nail. Unctuous to the touch; adhering to the tongue. BB yields water and then burnt odor. Violet-red with Co solution. *A.* Chalcedony, Opal, Chlorite.
Mcl. *H.* short colmn., tabular.	*Cl.* i perfect	$Na_2B_4O_7.10H_2O$	G. 1.7. Soluble in water. BB puffs up and fuses to a clear bead called borax glass. Fused with fluorspar and $KHSO_4$ colors flame green. *A.* In waters of salt lake of Thibet and in mineral springs of Chambly (Canada East) and Borax Lake, Cal., and the Tuscan lagoons.
Isom. *H.* pentagonal, hmhdrl. *S.* lamellar	*Fr.* fibrous.	$AlNH_4(SO_4)_2.12H_2O$	G. 1.5. Soluble in water. Alum taste. Yields water and sublimes, leaving coat of itself on tube. Melts in flame. Deprived of water, infus. *A.* Clay. Gypsum.

NAME.	LUSTRE.	COLOR.	HARD'SS.	TENACITY.
Goslarite‡ (White Vitriol, Zinkvitriol)	vitreous	white, gray	2.25	brittle
Epsomite‡ (Bittersalz)	vitreous	white, pale yellow, pale red	2.25	brittle
Annabergite‡ (Nickelblüthe)	glinting to dull	apple-green	2.25	sectile to brittle
Hydrozincite (See pp. 70, 130)				
Pharmacolite‡ (Arsenblüthe)	vitreous, pearly, silky	white	2.25	sectile
Coquimbite				
Senarmontite‡	adamantine resinous	white, gray	2.25	brittle to sectile
Sideronatrite				
Chalcanthite (Blue Stone, Blue Vitriol, Kupfervitriol)	vitreous	blue	2.5	brittle to sectile
Quenstedtite				
Vivianite (Blaueisenerz)	vitreous, pearly, dull	blue, green, white	2.5	sectile
Nesquehonite				
Biotite (Magnesiaglimmer)	pearly on **0**	black, brown, dark green	2.5	brittle to sectile

CRYSTAL SYSTEM, HABIT, AND STRUCTURE.	CLEAVAGE AND FRACTURE.	CHEMICAL FORMULA.	REMARKS Sp. Gr., Reactions. *A* = Associated Minerals.
O'rhm. *H.* colmn., acic. *S.* reniform, incrustations.	*Cl.* ii observable. *Fr.* granular.	$ZnSO_4.7H_2O$	G. 2. Crystals rare. Soluble in water. Taste astringent, metallic, and nauseous. Yields water. BB *ch.* with soda, a coat of ZnO, and hepar reaction. *A.* Blende.
O'rhm. *H.* acic., capil. *S.* incrustations, coating.	*Cl.* i–i distinct. *Fr.* granular, fibr., earthy.	$MgSO_4.7H_2O$	G. 1.7. Crystals rare. Soluble in water. Taste bitter and saline. Melts in candle flame. *A.* Marl, Pyrite.
Mcl. *H.* capil., acic., scaly. *S.* coating, massive, intsp.	*Cl.* i–ì perfect. *Fr.* earthy.	$Ni_3(AsO_4)_2.8H_2O$	G. 3. BB, see II. 5.
Mcl. *H.* capil., acic. *S.* spherical, botryoidal, hepatic, incrusted, coating.	*Cl.* ii perfect. *Fr.* fibr., stellate, earthy.	$(Ca,Mg)_3(AsO_4)_2.6H_2O$	G. 2.6. BB in closed tube yields water and becomes opaque. BB in O.F. fuses with intumescence to enamel and colors flame light blue (As); ignited mineral alkaline to test paper. Insoluble in water, but readily soluble in acids. *A.* Niccolite, Chloanthite, Pyrargyrite.
Isom. *H.* octahedral. *S.* massive.	*Cl.* 1 distinct. *Fr.* granular, compact.	Sb_2O_3	G. 5.2. Melts in candle flame. BB in closed tube fuses and partially sublimes. On coal gives white coating, which, in R.F., colors outer flame greenish blue. *A.* Valentinite, Kermesite native Antimony.
Trcl. *H.* tab., scaly. *S.* incrusted, rounded, coating.	*Fr.* compact, stalky	$CuSO_4.5H_2O$	G. 2.2. Crystals rare. Treat metallic, astringent. Soluble in water. Moistened and rubbed on knife-blade coats it with copper. BB yields water and SO_2. With soda on coal, metallic Cu. *A.* Melanterite, Pyrite, Chalcopyrite.
Mcl. *H.* acic., scaly. *S.* masv., intsp.	*Cl.* i–ì perfect. *Fr.* fibrous, earthy.	$Fe_3(PO_4)_2.8H_2O$	G. ± 2.5. (See II. 6.)
Mcl. *H.* foliaceous, scaly, tabular, short colmn. *S.* masv., intsp.	*Cl.* 0 highly eminent. *Fr.* shelly, scaly.	$(Mg,Fe)_2(K,H)_2(Al,Fe)_2(SiO_4)_3$	G. 2.9. Crystals seem hex. Yields a little water. Whitens and fuses on thin edges. With fluxes, reaction for iron. *A.* Constituent of Granite, Gneiss, Mica Slate.

NAME.	LUSTRE.	COLOR.	HARD'SS.	TENACITY.
Ripidolite (Klinochlor)	pearly on **0**	green; when containing chromium, blue	2.5	sectile
Halite (Common Salt, Steinsalz)	vitreous to resinous	white, gray, blue (seldom), red (seldom)	2.5	brittle to sectile
Gay-Lussite				
Sylvite† (Sylvin)	vitreous to resinous	white, gray	2.5	brittle to sectile
Kainite	vitreous	yellow, gray	2.5	sectile to brittle
Thenardite				
Succinite† (Amber, Bernstein)	waxy	yellow, brown, red, white	2.5	brittle
Bieberite‡ (Kobaltvitriol)	silky to vitreous	flesh- to rose-red	2.5	sectile to brittle
Amarantite (Hohmannite)				
Muscovite (Potash Mica, Kaliglimmer)	pearly on **0**, often metalloid	gray, white, light yellow, light brown	2.5	sectile
Valentinite† (Weissspiessglaserz)	adamantine pearly on **0**	white, gray, light yellow, light brown	2.5	sectile

CRYSTAL SYSTEM, HABIT, AND STRUCTURE.	CLEAVAGE AND FRACTURE.	CHEMICAL FORMULA.	REMARKS. Sp. Gr., Reactions. *A* = Associated Minerals.
Mcl. (?) *H.* foliaceous, scaly, tab., pyr. *S.* masv., intsp., small reniform, lamellar.	*Cl.* **0** perfect. *Fr.* scaly, compact, short fibr.	$(Mg,Fe)_5Al_2H_9Si_3O_{20}$	G. ± 2.7. Crystals seem hexagonal. Often strongly dichroic. Transp. to transluc. crystals flexible and somewhat elastic. BB yields water. In platinum forceps fuses on edges to gray-black glass. In H_2SO_4 wholly decomp. *A.* Garnet, Diopside, Titanite, Adularia, Albite, Magnetite, Penninite, Serpentine, Chromite.
Isom. *H.* hexhdl. *S.* masv., intsp., lamellar.	*Cl.* cubic, perfect. *Fr.* gran., fibr.	NaCl	G. ± 2.1. Taste pure saline. Soluble in water. Solution precipitates $AgNO_3$. BB fuses often with decrepitation, and colors flame deep yellow. *A.* Clay, Gypsum, Anhydrite.
Isom. *H.* hexhdl., cubo-octdl. *S.* massive.	*Cl.* cubic, distinct. *Fr.* granular.	KCl	G. 2. Soluble in water. Pungent taste. BB melts on wire, coloring flame violet. *A.* Carnallite, Halite, Kainite.
Mcl. *H.* tabular. *S.* massive.	*Cl.* i–ī distinct I less so. *Fr.* fine gran.	$KCl,MgSO_4.3H_2O$	G. 2.1. Soluble in water. Taste pungent. BB melts in flame. *A.* Carnallite, Sylvite, Halite.
Amorphous. *S.* masv., lamel.	*Fr.* masv., conchoidal	$C_{40}H_{64}O_4$	G. ± 1. Electric by friction. Melts in candle flame and burns with illum. flame and pleasant odor. With H_2SO_4 brown solution. *A.* In loose masses, also in clays and marls sometimes.
Mcl. *S.* efflorescence.	*Fr.* crumbly	$CoSO_4.7H_2O$	G. 1.9. Taste astringent. Soluble in water. Yields water and SO_2 in closed tube. Blue, borax glass bead. *A.* Product of decomp. of cobaltiferous minerals.
Mcl. *H.* foliaceous, scaly, tab., pyr. *S.* masv., intsp.	*Cl.* **0** perfect. *Fr.* shelly, scaly, compact.	$(K,Na)H_2Al_3(SiO_4)_3$	G. 3. Crystals seem hex. In closed tube gives water. BB whitens and fuses on thin edges to gray or yellow glass. *A.* Principal constituent of Mica-schist, Gneiss, and Granite. Does not occur with Augite nor with Labradorite.
O'rhm. *H.* scaly, acic., splintery. *S.* massive.	*Cl.* I perfect. *Fr.* short stellate.	Sb_2O_3	G. 5.5. Melts in candle flame. In closed tube fuses and partially sublimes. BB *ch.* fuses easily and gives white coat, which imparts to R.F. green-blue color. *A.* Antimonite, Kermesite, Galenite, Blende.

NAME.	LUSTRE.	COLOR.	HARD'SS.	TENACITY.
Hydrozincite ‡ (Zinkblüthe) See p. 130)	dull	white	2.5	sectile to brittle
Deweylite† (Gymnit)	resinous	yellow	2.5	brittle
Lepidolite† (Lithionglimmer, Lithionit)	**0** pearly, partly submetallic	violet, light red, dark green, gray	2.5	sectile
Phlogopite†	**0** pearly	brown, red, yellow	2.5	sectile to brittle
Matlockite				
Langite				
Zinnwaldite				
Sussexite				**2.**
Carnallite‡	vitreous	red, white	3	brittle
Glauberite‡	vitreous to resinous	white, gray, light yellow	3	brittle
Mellite‡ (Honigstein)	greasy	yellow, brown, white	3	brittle

CRYSTAL SYSTEM, HABIT, AND STRUCTURE.	CLEAVAGE AND FRACTURE.	CHEMICAL FORMULA.	REMARKS. Sp. Gr., Reactions. *A* = Associated Minerals.
(?) *S.* masv., reniform.	*Fr.* conchoidal, shelly, granular, compact, earthy	$Zn(OH)_2(ZnOH)_2CO_3$	G. ± 3.6. Soluble with effervescence. In closed tube yields water. BB yields CO_2, is yellow while hot. Coats coal near assay, which, with soda, yields Zn vapors. Moistened with Co sol. turns green. *A.* Calamine, Smithsonite.
Amorphous. *S.* massive.	*Fr.* compact	$Mg_4H_4Si_3O_{12}$	G. 2.2. Closed tube gives much water. BB fuses on edges and becomes opaque. Decomposed by HCl. *A.* Serpentine, Magnesite.
Mcl. *H.* foliaceous, scaly. *S.* massive.	*Cl.* **0** highly eminent. *Fr.* scaly, gran.	$Al_2Fe(Li,K,Na)_3(OH,F)_2Si_5O_{16}$	G. ± 2.9. Crystals seem hex. Melts in candle flame. Yields water. BB fuses with intumescence and colors flame lithium-red. *A.* Tourmaline bearing granites, and with tin ore.
Mcl. *H.* foliaceous, scaly, tab. *S.* interspersed.	*Cl.* **0** highly eminent	$(Al,Fe)_2(Mg,Fe)_6(K,Na)_2(OH,F)_2Si_6O_{21}$	G. 2.9. Crystals seem hex. Yields water which often tests for F. BB whitens and fuses on edges. Decomposed by H_2SO_4. *A.* Especially characteristic of serpentine and crystalline limestone and dolomite.

Sectile.

O'rhm. *H.* pyramidal. *S.* massive.	*Fr.* coarsely gran., compact	$MgCl_2.KCl.6H_2O$	G. 1.6. Crystals rare. Deliquescent. Taste pungent. Melts in candle flame. BB fuses easily. Soluble in water. Strongly phosphorescent. *A.* Sylvite, Kieserite, Halite.
Mcl. *H.* tab., colmn. *S.* massive.	*Cl.* **0** perfect. *Fr.* thin shelly.	$Na_2Ca(SO_4)_2$	G. ± 2.7. Taste bitter. Partially soluble in water. Melts in candle flame. BB decrepitates, turns white, and fuses, coloring flame yellow. With soda gives hepar reaction. *A.* Halite, clay.
Tetrag. *H.* pyramidal.	*Cl.* 1 distinct	$Al_2C_{12}O_{12}.18H_2O$	G. ± 1.5. Whitens in candle flame but does not take fire. Yields water. Decomposed by boiling water. Soluble in HNO_3. *A.* Lignite.

NAME.	LUSTRE.	COLOR.	HARD'SS.	TENACITY.
Phosgenite‡ (Bleihornerz)	adamantine to resinous	gray-white, pale yellow, pale green	3	brittle
Gibbsite				
Mendipite‡ (Chlorspath, Berzelite)	adamantine, pearly on cleavage planes	yellow, white to pale yellow	3	brittle
Caledonite‡ (Allied to Leadhillite)	resinous	verdigris-green mountain-green	3	brittle
Arsenolite‡ (Arsenolith)	adamantine	white	3	sectile
Wulfenite† (Gelbbleierz)	adamantine, vitreous, resinous	yellow, white, gray, red	3	brittle to sectile
Stolzite‡ (Scheelbleierz)	resinous	gray, brown	3	sectile
Calcite (Calc Spar, Iceland Spar)	vitreous, dull	in all colors, generally white	3	brittle

CRYSTAL SYSTEM, HABIT, AND STRUCTURE.	CLEAVAGE AND FRACTURE.	CHEMICAL FORMULA.	REMARKS. Sp. Gr., Reactions. A = Associated Minerals.
Tetrag. *H.* colmn., pyr., cuboid.	*Cl.* I and ii perfect **0** distinct	$(PbCl)_2CO_3$	G. ± 6.2. Melts in candle flame. Effervesces with acids. BB melts easily to yellow globule, which, on cooling, becomes white and crystalline. *Ch.* in R.F. metallic lead and white coat of $PbCl_2$. Bead of mercsm. salt with Cu gives reaction for Cl. *A.* Cerussite, Galenite.
O'rhm. *H.* columnar. *S.* radial.	*Cl.* I perfect I ∧ I 102° 36′	$Pb_3O_2Cl_2$	G. ± 7.1. In closed tube decrepitates and becomes more yellow. BB fuses easily to lead button, and with mercsm. bead and Cu shows Cl. *A.* Earthy Manganese Oxide, clay.
Mcl. *H.* columnar. *S.* massive.	*Cl.* ii, also I and **0**. *Fr.* uneven.	$(Pb,Cu)_2SO_4CO_3$	G. ± 6.4. Partly soluble in HCl with effervescence. With soda, in R.F., button of lead. *A.* Lead ores, Linarite.
Isom. *H.* octdl., capil. *S.* botryoidal, stalac., earthy.	.....	As_2O_3	G. ± 3.7. Sublimes in tube, condensing on walls in minute octahedrons. BB *ch.* volatilizes, giving As odor amd white fumes. An isomeric mineral, Claudetite, crystallizes monoclinic. *A.* Ores of silver, lead, arsenical iron, etc.
Tetrag. *H.* tab., cuboid, pyramidal. *S.* massive.	*Cl.* 1 very smooth **0** distinct. *Fr.* granular.	$PbMoO_4$	G. ± 6.5. Closed tube decrepitates and fuses. BB, with borax, colorless glass, which, in R.F., becomes dirty green. *Ch.*, with soda, metallic lead. *A.* Calcite, Galenite.
Tetrag. *H.* pyr., cuboid, short tabular.	*Cl.* **0** imperf.	$PbWO_4$	G. ± 8. BB decrepitates and fuses to a crystalline, lustrous, and metallic pearl. With mercsm. salt in O.F. colorless glass, which, in R.F., becomes blue on cooling. Decomp. by HNO_3, leaving yellow residue of H_2WO_4. *A.* Lepidolite, smoky Quartz.
Hex. *H.* r'dl., colmn., acicular, tab., scalenohedral. *S.* masv., intsp., rounded, lamel.	*Cl.* R, 105°, highly perfect. *Fr.* gran., compact, stalky, fibr., earthy.	$CaCO_3$	G. ± 2.6. BB infusible. Strongly luminous. Soluble in acids with effervescence. *A.* In ore veins, limestone, geodes, etc., very widely distributed.

NAME.	LUSTRE.	COLOR.	HARD'SS.	TENACITY.
Vanadinite‡ (Vanadinspath, Vanadinbleispath)	resinous	yellow, brown	3	brittle
Anhydrite (Karstenit)	vitreous, ii pearly, resinous	white, pale red, pale blue, gray	3	brittle
Celestite (Cölestin)	vitreous, 0 somewhat pearly	white, blue	3	brittle
Barite (Heavy Spar, Barytes, Schwerspath)	vitreous, 0 somewhat pearly, resinous, silky	all colors, principally red and yellow	3	brittle
Anglesite (Vitriolbleierz)	adamantine resinous	white	3	brittle
Beauxite (Bauxite)	dull, earthy	whitish, grayish to ochre-yellow, brown, and red	3 (?)	sectile
Polyhalite‡	vitreous, resinous, silky	red, gray	3	brittle

CRYSTAL SYSTEM, HABIT, AND STRUCTURE	CLEAVAGE AND FRACTURE.	CHEMICAL FORMULA.	REMARKS. Sp. Gr., Reactions. A = Associated Minerals.
Hex. *H.* acic, short columnar. *S.* small reniform.	*Fr.* fine stalky, fibrous	$Pb_5Cl(VO_4)_3$	G. ± 6.9. In closed tube decrepitates and yields faint white sublimate. BB *ch.* fuses to black mass, which, in R.F., gives metallic bead. After oxidizing all the lead the black residue gives, with mercsm. salt in R.F., green bead, which becomes yellow in O.F. *A.* Calcite, Galenite.
O'rhm. *H.* tab., cuboid, splintery, short columnar. *S.* masv., lamel.	*Cl.* i ĭ perfect i $\bar{1}$ } **0** } dist. *Fr.* granular, stalky, compact, splintery.	$CaSO_4$	G. 2.9. Crystals rare. Soluble in HCl. BB fuses, coloring flame reddish yellow, and yielding bead which reacts alkaline. *A.* Clay, Calcite, Gypsum, Halite.
O'rhm. *H.* tab., colmn., acic. *S.* masv., lamel., nodular.	*Cl.* **0** perfect I observbl. I ∧ I, 104° *Fr.* stalky, fibr., fine gran., compact.	$SrSO_4$	G. 4. BB frequently decrepitates and fuses to white pearl, coloring flame red, and giving off SO_2. *Ch.* fuses easily to a button. Residue alkaline. With soda, hepar reaction on silver. *A.* Limestone, marl. Calcite, Gypsum, Sulphur, also in Galena veins.
O'rhm. *H.* tab., colmn., acic., pyr. *S.* rounded, lamellar, masv.	*Cl.* **0** perfect I observbl. I ∧ I, 102° *Fr.* shelly, fibr., gran., compact, earthy	$BaSO_4$	G. 4.3–4.7. BB decrepitates and fuses, coloring flame yellowish green and giving off SO_2. With soda, hepar reaction on silver. *A.* Fluorite, Galenite, Argentite, Pyrargyrite, Proustite, Niccolite, Chloanthite, Chalcopyrite, Pyrolusite, Psilomelane, Hematite, Limonite. Frequent in gangues of silver and lead ores.
O'rhm. *H.* tab., colmn., acic., pyr. *S.* massive.	*Cl.* **0** perfect I observbl. I ∧ I, 104° *Fr.* compact.	$PbSO_4$	G. ± 6.2. Crystals rare. Decrepitates. Fuses in candle flame. BB *ch.*, in O.F., clear bead, which becomes milk-white on cooling. R.F. reduced with effervescence to metallic lead. With soda, hepar reaction. *A.* Cerussite, Galenite.
(?) *S.* in round dissem. grains, masv., oolitic, earthy.	*Fr.* earthy	$Al_2O(OH)_4$	G. 2.5. In matrass yields water. With cobalt solution, blue color. *A.* Limestone.
(?) (usually compact, fibrous) *H* splintery. *S.* massive.	*Fr.* stalky, fibr.	$Ca_2Mg,K_2(SO_4)_4.2H_2O$	G. 2.7. Crystals rare. Melts in candle flame. Yields water. BB fuses and colors flame yellow. *Ch.* fuses to reddish bead, which in R.F. becomes white. Partially soluble in water, leaving $CaSO_4$, which dissolves in large excess of water. *A.* Halite.

NAME.	LUSTRE.	COLOR.	HARD'SS.	TENACITY.
Kieserite† (Kieserit)	glinting	white, gray, light yellow	3	brittle
Cryolite (Kryolith)	vitreous, pearly	white, gray	3	brittle
Allophane† (Riemannit)	vitreous	white, blue, yellow, green, brown	3	brittle
Pachnolite				
Wavellite† (Hydrargyrite, Striegisan)	vitreous, silky	in all colors, principally yellow, green, and white	3	brittle
Fibroferrite				
Hanksite				
Römerite				
Laurionite				
Peganite‡	vitreous, resinous	green, gray, white, bluish	3.5	brittle
Dickinsonite				
Adamite‡	vitreous to adamantine	honey-yellow; externally, often violet. Streak, white	3.5	sectile
Roselite				
Pyromorphite (Grünbleierz, Braunbleierz, Buntbleierz)	resinous to vitreous or adamantine	green, brown, yellow, white	3.5	brittle

CRYSTAL SYSTEM, HABIT, AND STRUCTURE.	CLEAVAGE AND FRACTURE	CHEMICAL FORMULA.	REMARKS. Sp. Gr., Reactions. *A* = Associated Minerals.
Mcl. *H.* pyramidal. *S.* massive.	*Cl.* 1 distinct. *Fr.* gran., compact.	$MgSO_4.H_2O$	G. 2.5. Weathers easily. Absorbs water. Crystals rare. Soluble in water. Fuses easily. *A.* Carnallite. Sylvite, Halite.
Mcl. *H.* short colmn., cuboid. *S.* massive.	*Cl.* in three nearly perpendicular planes. *Fr.* coarse gran., large shelly.	$AlF_3.3NaF$	G. ± 3. Crystals rare and apparently isom. Melts in candle flame. Heated in open tube so that flame enters tube, gives off HOF and etches glass. Colors flame yellow, and gives blue with Co solution. *A.* Siderite, Galenite, Chalcopyrite, Zincblende.
Amorphous. *S.* usually in thin incrustations, mammillary, stalactitic, massive.	*Fr.* conchoidal, compact	$Al_2SiO_5.5H_2O$	G. 1.8. Yields much water in closed tube. Crumbles. Gelatinizes with HCl. BB infusible. *A.* Limonite, alum slates.
O'rhm. *H.* acicular. *S.* reniform, hemispherical.	*Cl.* distinct. *Fr.* radial.	$((Al.OH)_3(PO_4)_2)_2.9H_2O$	G. 2.3. Crystals small and rare. Yields much water, last portions of which taste acid. BB, in forceps, swells and splits to fine acicular particles, which are infusible, but color flame green. With Co solution, blue. *A.* Hematite, Limonite, Pyrolusite, quartz slates, sandstones.
O'rhm. *H.* short acic. *S.* incrusted, warty.	*Fr.* short fibr. to compact	$(OH_3Al_2PO_4)_2.3H_2O$	G. 2.5. Yields water and becomes violet. Cracks open. BB infusible. *A.* Wavellite.
O'rhm. *H.* short colmn. *S.* interspersed, coating.	*Cl.* i–ī very distinct	$(ZnOH)ZnAsO_4$	G. 4.34. Easily soluble in dilute HNO_3. In matrass decrepitates feebly and yields a little water, becoming white and porcelanous. With soda, a ring of As. BB *ch* coating of ZnO and feeble odor of As. Borax, in O.F., pearl yellow, but colorless on cooling. *A.* Limonite, native Silver.
Hex. *H.* long and short columnar, acicular. *S.* reniform, botrydl., masv., incrusted.	*Fr.* compact, short radial	$Pb_5Cl(PO_4)_3$	G. 6.5–7.1. In closed tube, white sublimate ($PbCl_2$). Fuses easily, coloring flame bluish green. BB *ch* fuses, and, on cooling, assumes polyhedral forms. Soluble in HNO_3. Cl reaction with mercsm salt and CuO. *A.* Cerussite, Galenite, Barite.

NAME.	LUSTRE.	COLOR.	HARD'SS.	TENACITY.
Chrysocolla (One variety) (Kieselkupfererz) (See II. 2, 3, 5)	dull, usually glinting; when lustrous, greasy	verdigris-green to sky-blue	3.5	brittle
Descloizite (Rhombischer Vanadit)	vitreous	black to olive-brown	3.5	sectile
Stilpnomelane **Chalcodite**				
Mimetite† (Mimetesit, Kampylit)	resinous to adamantine	yellow, brown, white, gray	3.5	brittle
Cerussite (Weissbleierz)	adamantine, resinous, pearly, silky	white, gray, black, brown	3.5	brittle
Laumontite‡ (Caporcianite)	vitreous, silky, I pearly	white, pale yellow, pale red	3.5	brittle
Chiolite				
Picrolite (Serpentine, Chrysotile, Ophite)	feebly lustrous to earthy; *chrysotile* silky	dark green, less frequently yellow, red, brown	4	brittle to sectile
Bindheimite				
Stilbite† (Desmin)	vitreous, silky, i–ĭ pearly	white, less frequently yellow, brown, and red	4	brittle
Heulandite‡ (Stilbite in part)	vitreous i–ì pearly	white, red, less frequently yellow, brown	4	brittle

CRYSTAL SYSTEM, HABIT, AND STRUCTURE.	CLEAVAGE AND FRACTURE.	CHEMICAL FORMULA.	REMARKS. Sp. Gr., Reactions. *A* = Associated Minerals.
Amorphous. *S.* fine reniform, botrydl., masv., intsp.	*Fr.* massive, conchoidal in part	$CuSiO_3.2H_2O$	G. ± 2.2. BB infusible. In closed tube blackens and yields water. With fluxes, reaction for copper. Gelatinizes with acids. *A.* Malachite, Cuprite, Chalcopyrite, Limonite.
O'rhm. *S.* in clusters.	.....	$(Pb,Zn)VO_4(Pb,OH)$	G. 5.8. In matrass gives water. BB fuses and is partially reduced to button of metallic lead in a thick scoria. With borax in R.F. green glass, and with nitre in O.F. violet color, due to Mn. Microcosmic salt, chrome-green glass, orange-yellow in O.F. Dissolves in cold dilute HNO_3. *A.* Green Pyromorphite.
Hex. *H.* short and long columnar, acic., thick tab., pyramidal.	*Cl.* 1 distinct	$Pb_5Cl(AsO_4)_3$	G. ± 7.1. Closed tube, white sublimate ($PbCl_2$). BB fuses to button. In R.F., As odor and reduced to metallic lead. Reacts for Cl with bead of mercsm. salt saturated with CuO by coloring flame azure blue. *A.* Limonite, Psilomelane.
O'rhm. *H.* colmn., acic., tabular, pyr. *S.* massive, incrustations.	*Cl.* I perfect 1–ĭ distinct i–ĭ distinct. *Fr.* fine gran., earthy, compact.	$PbCO_3$	G. 6.4. Sometimes crystals seem hexag. Often twins, and closed tube decrepitates and turns yellow. BB fuses very easily, and in R.F. yields metallic lead. Soluble with effervescence in HNO_3. *A.* Pyromorphite, Galenite, Malachite, Limonite.
Mcl. *H.* colmn., acic. *S.* massive.	*Cl.* I distinct. *Fr.* stalky.	$Al_2(OH)_4Ca(Si_2O_5)_2.2H_2O$	G. 2.3. Weathers easily. Gelatinizes with HCl. BB fuses easily and swells up to white enamel. *A.* Stilbite, Calcite.
O'rhm. *S.* massive, incrusted.	*Fr.* compact, conchoidal, splintery	$(Mg,Fe)_3H_4Si_2O_9$	G. ± 2.6. Yields water; fuses on edges with difficulty. Decomposed by HCl and H_2SO_4. Chrysotil leaves SiO_2 in fine fibres.
Mcl. *H.* broad colmn, splintery. *S.* massive.	*Cl.* in one direction	$(Ca,Na_2K_2)Al_2Si_6O_{16}.6H_2O$	G. 2.1. Crystals simulate o'rhm. Attacked by acids without gelatinizing. BB exfoliates and curves into vermicular forms, and fuses to a white enamel. *A.* Heulandite, Chabasite, Laumontite, Calcite.
Mcl. *H.* tab., scaly, short colmn. *S.* masv., intsp.	*Cl.* eminent in one direction. *Fr.* thin shelly.	$Al_2(Ca,Sr)H_4(SiO_3)_6.3H_2O$	G. ± 2.2. Decomposed by HCl without gelatinizing. BB curls up, exfoliates, and fuses to white enamel. *A.* Stilbite, Calcite.

NAME.	LUSTRE.	COLOR.	HARD'SS.	TENACITY.
Scorodite† (Arseniksinter, Eisensinter)	vitreous	green, brown	4	brittle
Alunite† (Alaunspath)	vitreous, 0 pearly	white, gray, light yellow, light red, brown	4	brittle
Strontianite	vitreous, resinous	white, gray, pale yellow, pale green	4	brittle
Witherite†	vitreous to resinous	white, gray, pale yellow	4	brittle
Aragonite	vitreous, silky, resinous	white, gray, pale yellow, less frequently green, blue, red, violet	4	brittle
Bromlite (Alstonite)	vitreous, resinous	white	4	brittle
Barytocalcite	vitreous	white, yellowish	4	brittle

CRYSTAL SYSTEM, HABIT, AND STRUCTURE.	CLEAVAGE AND FRACTURE.	CHEMICAL FORMULA.	REMARKS. Sp. Gr., Reactions, *A* = Associated Minerals.
O'rhm. *H.* pyramidal, short colmn., short acicular. *S.* masv., finely reniform.	*Cl.* i–ĭ distinct. *Fr.* stalky, fine-gran., compact.	$FeAsO_4.2H_2O$	G. ± 3.2. In closed tube yields neutral water and turns yellow. BB fuses easily, coloring flame blue, leaving magnetic scoria. *A.* Pharmacosiderite, Limonite, Arsenopyrite, Pyrite.
Hex. *H.* r'dl., tab., like octahedral, like hexahedrl. *S.* massive, nodular.	*Cl.* 0 perfect. *Fr.* granular, masv., earthy.	$(AlO)_3K(SiO_4)_3.3H_2O$	G. ± 2.6. Crystals very small. Decrepitates and is infusible. Yields water, sometimes $(NH_4)_2SO_4$. With Co solution yields fine blue color. With soda, hepar reaction. *A.* On Trachyte. Nodular. In sand.
O'rhm. *H.* acic., dart-like, acute pyr. *S.* massive.	*Cl.* I distinct 1–ĭ " *Fr.* fibrous, thin stalky.	$(Sr,Ca)CO_3$	G. ± 3.7. BB swells up. Throws out minute sparks, fuses only on thin edges, and colors flame Sr red. Effervesces with acids. H_2SO_4 produces precipitate in dilute solution. *A.* Silver, Lead, and Copper veins; also in deposits by itself.
O'rhm. *H.* pyr., tab., columnar. *S.* massive, reniform.	*Cl.* I distinct i–ĭ, i–ĭ } less so. *Fr.* radial.	$BaCO_3$	G. ± 4.2. Crystals simulate hex. BB fuses to bead and colors flame yellowish green. Assay tests alkaline after fusion. Dissolves in HCl with effervescence. The dilute solution precipitates white with H_2SO_4. *A.* Galenite, Alstonite, Barytocalcite.
O'rhm. *H.* acic, long and short columnar, thick tab., dart like, chisel-like. *S.* masv., lamel., renfrm, spherdl, hackly, incrust.	*Cl.* i–ĭ distinct I } 1–ĭ } traces. *Fr.* stalky, fibr., shelly, compact.	$CaCO_3$	G. 2.9. Often twinned and multiple twinned. BB falls to pieces, loses CO_2, and glows brightly. Dissolves with effervescence in acids. Moistened with HCl gives Ca color to flame. *A.* In veins of limestone, Dolomite, and basalt. In Gypsum, Limonite, and Siderite deposits.
O'rhm. *H.* acute pyr. *S.* massive.	*Fr.* fibrous, granular	$(Ca,Ba)CO_3$	G. 3.7. Crystals simulate hexagonal. Soluble in hydrochloric acid with effervescence. BB fuses on thin edges and colors flame yellowish green. Alkaline after ignition. *A.* Witherite, Barytocalcite.
Mcl *H.* acicular. *S.* massive.	*Cl.* I perfect. *Fr.* granular, stalky.	$(Ca,Ba)CO_3$	G. 3.6. Dissolves in dilute HCl. BB infusible. Colors flame yellowish green. Strong ignition pale green color and afterwards alkaline reaction. *A.* Alstonite, Witherite.

NAME.	LUSTRE.	COLOR.	HARD'SS.	TENACITY.
Triphylite† (Triphylin)	resinous	greenish, gray, blue in spots	4	brittle
Picrolite‡ (Variety Serpentine) (See III. 2, *ante*)	feebly waxy	yellow, green, white	4	brittle to sectile
Zinc Blende (Blende, Black Jack, Sphalerite)	adamantine	yellow, red, green, and white very seldom	4	very brittle
Bismutite (Bismutosphärit, Wismuthocher in part)	generally dull or glinting, resinous	gray, light yellow, light green	4	brittle
Fluorite	vitreous	in all colors; black, red, and brown are most *uncommon*	4	brittle
Ankerite (Braunspath in part)	vitreous, pearly	gray, white, yellowish, brownish	4	brittle
Dolomite (Bitterspath, Braunspath in part)	vitreous R partly pearly	white, gray, yellow, red, brown, green	4	brittle

CRYSTAL SYSTEM, HABIT, AND STRUCTURE.	CLEAVAGE AND FRACTURE.	CHEMICAL FORMULA.	REMARKS. Sp. Gr., Reactions. A = Associated Minerals.
O'rhm. *S.* massive.	*Cl.* i–ī distinct 0 less so. *Fr.* large gran.	$Li(Fe,Mn)PO_4$	G. ± 3.6. Weathers. BB turns dark and gives off some water. Fuses, coloring flame Li red, with pale bluish green at exterior cone of flame. With borax, an iron bead. With soda, reaction for Mn. Soluble in HCl. *A.* Beryl. In granite.
Amorphous. *S.* incrusted, massive.	*Fr.* compact; in large pieces, conchoidal; in small, splintery	$(Mg,Fe)_3H_4Si_2O_9$	G. ± 2.5. Greasy to touch. Bitter odor when breathed on. Fibres not flexible. Yields water. Fuses on edges with difficulty. *A.* Serpentine.
Isom. *H.* octahedral, tetrdl., dodecdl. *S.* masv., intsp., rounded.	*Cl.* I perfect. Bethlehem variety very slight. *Fr.* granular, compact.	ZnS or $(Zn,Fe,_{Mn,Cd})S$	G. ± 4. Open tube SO_2, and generally changes color. BB very difficult to fuse. *Ch.*, with soda, green Zn flame. In R.F. on coal a zinc coat. Bethlehem variety crypto-crystalline. *A.* (1) Arsenopyrite, Chalcopyrite, Pyrite, Galenite, Siderite, Baryte. (2) Pyroxene, Aplome-Garnet, Magnetite, Magnetopyrite. Frequent in gangues of silver and lead ores.
Crystalline. *S.* masv., intsp., small spheroid.	*Fr.* earthy, compact, crumpled, shelly	$BiO.Bi(OH)_2CO_3$	G. 6.9. Soluble in HCl with effervescence and deep yellow solution. Melts in candle flame. In matrass decrepitates and gives water. BB R.F. button of Bi and gives coal yellow coat. *A.* Native Bismuth and Bismuthinite.
Isom. *H.* hexahedral, octahedral. *S.* masv., intsp.	*Cl.* 1 perfect. *Fr.* stalky, compact, gran., earthy.	CaF_2	G. ± 3.1. In closed tube decrepitates, loses color, and phosphoresces. BB fuses, coloring flame red. Residue reacts alkaline. With H_2SO_4, fumes etch glass. *A.* In gangues of metallic ores. In beds and veins. With gneiss, mica slate, clay slate, and in limestones. With a great many minerals.
Hex. *H.* obtuse r'dl. *S.* massive.	*Cl.* R, 106°, perfect; faces often curved. *Fr.* granular.	$(Ca,Mg,Fe,_{Mn})CO_3$	G. 3. Soluble with effervescence in HCl. BB infusible. Darkens and becomes magnetic. *A.* Siderite, Galenite, Blende.
Hex. *H.* acute or obtuse r'dl. *S.* massive.	*Cl.* R, 106°, perfect; faces often curved. *Fr.* granular, compact.	$(Mg,Ca)CO_3$	G. 2.8. Soluble with effervescence in warm HCl, slowly in cold HCl. BB does not fuse to clear mass with soda on platinum foil. Glows and gives off CO_2. *A.* In extensive beds. Serpentine and other magnesian rocks. With a great many minerals.

NAME.	LUSTRE.	COLOR.	HARD'SS.	TENACITY.
Pistomesite (Breunnerite)	vitreous, R pearly	yellowish white yellowish gray	4	brittle
Crocidolite				
Siderite (Spathic Iron, Eisenspath, Spatheisenstein)	vitreous, R pearly	pea-yellow Isabella-yellow yellow-gray yellow-brown	4	brittle
Colemanite				
Levynite				

3.

NAME.	LUSTRE.	COLOR.	HARD'SS.	CRYSTAL SYSTEM, HABIT, AND STRUCTURE.
Magnesite† (Talkspath, Bitterspath)	vitreous, dull	white, pale yellow, gray, black	4.5	Hex. *H.* obtuse r'dl. *S.* massive, reniform.
Seybertite				
Rhodochrosite† (Rose Spar, Manganspath, Manganocalcit, Dialogit)	vitreous, partly pearly and resinous	rose-red	4.5	Hex. *H.* obtuse and acute r'dl., acute scalenohedral. *S.* spherical, reniform, massive.
Ralstonite				
Yttrocerite				
Smithsonite (Zinkspath, Galmei in part)	vitreous to resinous	white, pale yellow, pale green, gray, brown	4.5	Hex. *H.* obtuse and acute r'dl., acute scalenohedral. *S.* botrydl., reniform, warty, masv.
Cervantite				
Margarite† (Perl-Glimmer, Kalkglimmer)	O pearly	white, gray, pale green	4.5	Mcl. *H.* thin tabular, scaly. *S.* massive.

TAL SYSTEM, ABIT, AND RUCTURE.	CLEAVAGE AND FRACTURE.	CHEMICAL FORMULA.	REMARKS, Sp. Gr., Reactions. *A* = Associated Minerals.
btuse r'dl. assive.	*Cl.* R perfect. *Fr.* coarsely granular, large granular	$(Mg,Fe)CO_3$	G. 4. Soluble with effervescence in warm HCl. BB infusible. *A.* Pyrite, Specularite.
btuse r'dl., c., scalndl., e r'dl. asv., reni-, warty, ular, lamel.	*Cl.* R, 107°, perfect; faces often curved. *Fr.* gran., compact, shelly, rarely fibrous.	$FeCO_3$	G. ± 3.8. Dissolves with effervescence in warm HCl. BB decrepitates, evolves CO_2, blackens, and becomes magnetic. With fluxes reacts for Fe, and with soda and nitre on platinum foil generally for Mn. *A.* In silver and tin gangues, also with gneiss, mica slate, and clay slate, and as clay ironstone in coal measures.

ıi-hard.

CLEAVAGE AND FRACTURE	CHEMICAL FORMULA.	REMARKS. Sp. Gr., Reactions. *A* = Associated Minerals.
R, 107° 30′, ect. granular, com-, earthy.	$MgCO_3$	G. 3. Effervesces with acids. BB infusible, whitens, loses CO_2, and glows brightly. Residue alkaline. With Co solution on platinum foil red color. *A.* Chlorite slate, Talc slate, Serpentine.
R, 107°, per- curved faces art	$(Mn,Ca,Fe,Mg)CO_3$	G. ± 3.5. BB changes to gray, brown, and black. Decrepitates, but is infusible. With mercsm. salt and borax, in O.F., amethyst bead. R.F., by continued blowing, colorless. Co solution on platinum foil bluish green. Dissolves with effervescence in warm HCl. *A.* (1) Galenite, Blende, argentif. Tetrahedrite, native Gold. (2) Limonite, Hematite.
R, 108°, per- curved faces art	$ZnCO_3$	G. ± 4.2. Crystals mostly small. Soluble in warm HCl with effervescence. In closed tube yields CO_2, and is yellowish hot, and white cold. BB infusible. Co solution gives green color. *A.* Calamine, Galenite, Blende.
0 perfect. scaly, gran.	$H_2CaAl_4Si_2O_{12}$	G. 3. Yields water in closed tube. BB whitens and fuses on edges. *A.* Chlorite, Corundum, Magnetite, Rutile.

NAME.	LUSTRE.	COLOR.	HARD'SS.	CRYSTAL SYSTEM, HABIT, AND STRUCTURE.
Scheelite† (Scheelspath)	resinous to adamantine	brown, yellow, gray, white	4.5	Tetrag. *H.* pyr., seldom tab., lenticular. *S.* masv., intersp.
Gmelinite				
Triplite†	resinous	brown, black	4.5	Mcl. *S.* masv., intersp.
Prosopite				
Wollastonite†	vitreous, 0 pearly, silky	white, gray, seldom pale red, pale yellow	4.5	Mcl. *H.* tab., splintery. *S.* massive.
Childrenite				
Eosphorite				
Tysonite				
Thorite				
Chabazite† (Phakolith)	vitreous	white	4.5	Hex. *H.* r'dl, cuboid, obtuse pyr., lentic.
Lithiophilite				
Apophyllite† (Fischaugenstein, Ichthyopthalmit, Tesselite, Oxhaverite, Xylochlor, Leucocyclite)	vitreous 0 pearly	white, pale yellow, pale red	5	Tetrag. *H.* tab., colmn., acute pyr., cuboid. *S.* massive.
Eulytite‡ (Kieselwismuth, Agricolit)	adamantine	brown, yellow, gray, white	5	Isom. *H.* trigon., dodcl., often rounded. *S.* spheroidal. *Agricolit* Mcl.
Berzeliite				
Pyrrharsenite				
Calamine (Kieselzinkerz, Galmei in part, Hemimorphite)	vitreous, pearly, silky	white, pale yellow, pale blue	5	O'rhm. *H.* tab., splintery, acic., capillary. *S.* reniform, incrusted.
Enstatite† (Bronzite)	i–ĭ metallic, pearly, silky	brown, green	5	O'rhm. *H.* colmn., acic.
Variscite				

CLEAVAGE AND FRACTURE.	CHEMICAL FORMULA.	REMARKS. Sp. Gr., Reactions. *A* = Associated Minerals
Cl. 1, 2-i, **0** } perfect	$CaWO_4$	G. ± 6. Fuses to semi-transparent glass, which is opaque on cooling. BB, with mcrcsm. salt, a bead, colorless in outer flame; in inner, green while hot and blue when cold. Decomposed by HCl, leaving yellow residue, soluble in ammonia. *A.* (1) Wolframite, Cassiterite, Fluorite, Lepidolite. (2) Galenite, Blende, Siderite. (3) Magnetite, Blende, Pyrite. (4) On and in limestone.
Cl. i–ì distinct **0** less so	$(Fe,Mn)PO_4(Fe,Mn)F$	G. ± 3.6. BB fuses easily to black magnetic globule. With borax in O.F., amethyst bead of Mn; with soda, Fe reaction; with H_2SO_4, evolves F and etches glass. *A.* Apatite, Beryl.
Cl. i–ī, **0**, 1–ī, ½–ī } rather perfect. *Fr.* shelly, stalky, fibrous.	$CaSiO_3$	G. ± 2.8. Rubbed or warmed becomes phosphorescent in the dark. In matrass no change. BB fuses easily on edges. Gelatinizes with HCl. *A.* Calcite, Garnet, Vesuvianite, Graphite, Bornite.
Cl. R distinct	$Al_2(Ca)Si_6O_{16}.8H_2O$ $Al_2(Ca)_2Si_4Al_2O_{16}.8H_2O$	G. ± 2.1. Often twinned. BB intumesces and fuses to blebby glass nearly opaque. Decomposed by HCl with separation of gelatinous silica. *A.* Phillipsite, Stilbite, Heulandite, Analcite, Calcite.
Cl. **0** { highly perfect; i–i distinct. *Fr.* large shelly.	$(Ca_4KH_7(SiO_3)_8)_2.9H_2O$	G. 2.3. In closed tube exfoliates, whitens, and yields water. BB exfoliates and colors the flame violet. With acids, slimy silica. *A.* Analcite, Natrolite, Calcite.
Fr. radial.	$Bi_4(SiO_4)_3$	G. 6. In matrass decrepitates and yields a little water. BB fuses and froths on coal, staining it yellow-brown. Fuses with soda to button, at first greenish yellow, then reddish yellow, and yields finally metallic Bi. *A.* Bismutite, Hypochlorite.
Cl. I perfect, 1–ī distinct	$(Zn.OH)_2SiO_3$	G. 3.16–3.9. Crystals generally small. In closed tube decrepitates, whitens, and gives water. BB moistened with Co solution gives green color when heated. *Ch.* with soda gives yellow coat, which cools to white. By HCl decomposed and gives gelatinous silica. *A.* Smithsonite.
Cl. i–ī perfect, I imperfect, i–i in traces. *Fr.* large and coarse gran., fibr.	$(MgFe)SiO_3$	G. ± 3.2. BB infusible, being only slightly rounded on edges. Insoluble in HCl. *A.* Olivine, *never quartz*, Serpentine, basalt, meteorites.

NAME.	LUSTRE.	COLOR.	HARD'SS.	CRYSTAL SYSTEM, HABIT, AND STRUCTURE.
Apatite	vitreous resinous	in all colors	5	Hex. *H.* tab., colmn., acicular. *S.* massive, reniform, botryoidal.
Carpholite‡	silky	straw-yellow	5	Mcl. *H.* acic., capillary. *S.* massive.
Pyrgom or **Fassaite** (Green Augite in part. Variety Pyroxene)	vitreous, partly resinous	green, generally dark green	5	Mcl. *H.* short colmn., acute pyr. *S.* massive.
Haüynite	vitreous to resinous	blue, seldom white	5	Isom. *H.* dodcl., octdrl. *S.* intersp., masv.
Datolite (Humboldtite, Botryolit)	vitreous to resinous	white	5	Mcl. *H.* short colmn., thick tabular. *S.* massive, small reniform.
Harmotome (Kreuzstein, Morvenit)	vitreous	white, pale yellow, pale brown	5	Mcl. *H.* broad colmn., thick tabular.
Phillipsite (Kalkharmotom, Christianit)	vitreous	white	5	Mcl. *H.* short acicular.
Natrolite (Mesotype, Nadelzeolith) **Scolecite**	vitreous, I pearly and silky	white, pale yellow, pale red, ochre-yellow, brick red	5	Mcl. and O'rhm. *H.* acic., colmn., capillary. *S* reniform, incrustation, masv.

CLEAVAGE AND FRACTURE.	CHEMICAL FORMULA.	REMARKS. Sp. Gr., Reactions. *A* = Associated Minerals.
Cl. 0 distinct I distinct. *Fr.* fibrous, compact, earthy, gran.	$FCa_5(PO_4)_3$ $ClCa_5(PO_4)_3$	G. ± 3.1. BB fuses with difficulty on edges, coloring flame reddish yellow. Moistened with H_2SO_4 colors flame bluish green. Some varieties give blue flame when treated with mercsm. bead saturated with CuO—(Cl), and some give F when fused with mercsm. salt in open tube. *A.* (1) Cassiterite. Wolframite, Arsenopyrite, Fluorite. (2) Adularia, Quartz, Pistacite, Axinite, Titanite, Rutile, Specularite, Magnetite. (3) Chlorite slate, Talc slate. (4) Basalt, phonolite, diabase.
Fr. radial	$MnAl_2(OH)_4(SiO_3)_2$	G. 2.9. In closed tube gives some water, which reacts acid and attacks the glass (F). BB swells up and fuses to brown glass. With fluxes gives reactions for Mn and Fe. Not decomposed by HCl. *A.* Fluorite.
Cl. I distinct I ∧ I, 87°. *Fr.* gran., compact.	$MgCa(SiO_3)_2$	G. ± 3.3. Includes green pyroxene found in metamorphic rocks. Generally unacted on by acids. *A.* Calcite, Spinel. *Not Quartz.*
Cl. dodcl. distinct. *Fr.* gran., compact.	$(Ca,Na_2)Na_2(AlSO_4Na)$ $Al_2(SiO_4)_4$	G. ± 2.4. Crystals extremely rare. In closed tube retains its color. BB in forceps fuses to a white glass. With soda, *ch.*, gives hepar reaction with silver. Decomposed by HCl, with separation of gelatinous silica. *A.* In trachyte, basalt, phonolite, lava. *Not with Quartz.*
Cl. 0 distinct. *Fr.* granular, fine fibrous.	$Ca(B.OH)SiO_4$	G. 2.9. In closed tube yields much water. BB fuses with intumescence to clear glass, coloring flame bright green. Gelatinizes with HCl. *A.* Prehnite, Calcite, Magnetite.
Cl. i–ì distinct	$Al_2(Ba,Ca_2,Na_2,K_2)Si_6O_{16}\cdot 6H_2O$ $Al_2(Ba,Ca_2,Na_2,K_2)_2$ $Si_4Al_2O_{16}\cdot 6H_2O$	G. 2.4. Crystals seem o'rhm. or tetrag. Often in double twins. BB whitens and then crumbles, and fuses, without intumescence, to white translucent glass. Sometimes phosphorescent when heated. Gelatinizes with HCl. *A.* Calcite, Galenite.
Cl. i–ì distinct	$Al_2(Ca,Na_2,K_2)Si_6O_{16}\cdot 6H_2O$ $Al_2(Ca,Na_2,K_2)$ $Si_4Al_2O_{16}\cdot 6H_2O$	G. 2.2. BB, same as preceding. *A.* Analcite, Chabazite.
Cl. I perfect I ∧ I, 91°. *Fr.* radial, compact, earthy.	$(AlO)Na_2 2H_2O.$ $Al(SiO_3)_3$ or $Al_2(SiO_4)_3Na_2H_4$	G. ± 2.2. Dimorphic. Crystals often seem tetrag. Melts in candle flame. BB fuses quietly to a colorless glass. Gelatinizes with acids. *A.* Chabazite, Apophyllite, Calcite.

NAME.	LUSTRE.	COLOR.	HARD'SS.	CRYSTAL SYSTEM HABIT, AND STRUCTURE.
Opal	vitreous, waxy	in all colors, most frequently white, yellow, red, brown	5	Amorphous. *S.* masv., inters lamel., brecciat incrustations, rounded.
Perlite (Perlstein).	vitreous, partly pearly	gray	5	Amorphous. *S.* massive.
Mesolite				
Cerite (Ochroit, Cererit, Lanthanocerit)	resinous	reddish gray, brownish gray	5	O'rhm. *H.* short colmn *S.* massive.
Pitchstone† (Pechstein, Resinit).	resinous	green, red, brown, black	5	Amorphous. *S.* massive.
Hedenbergite (Iron-lime Pyroxene)	vitreous	leek-green olive-green dark green	5	Mcl. *S.* massive.
Pectolite				
Wagnerite‡	resinous	yellow, white	5	Mcl. *H.* short colmn *S.* massive.
Monticellite				
Monazite				
Eudialyte				
Cancrinite				
Amblygonite‡ (Montebrasit)	vitreous, resinous, pearly	white, gray, pale green, and yellowish green	5.5	Trcl. *S.* massive.
Lazulite† (Blauspath)	vitreous	blue	5.5	Mcl. *H.* pyr., tabula columnar. *S.* masv., inters

CLEAVAGE AND FRACTURE.	CHEMICAL FORMULA.	REMARKS. Sp. Gr., Reactions. A = Associated Minerals.
Fr. conchoidal, compact	$(H_2O)_x SiO_2$	G. ± 2. BB yields water. Infusible, but becomes opaque. Some yellow varieties turn red. *A.* In fractures of many rocks.
Fr. in large mass round granular; in small, conchoidal	$K_2Al_2Si_6O_{20}.H_2O$ Albite and Oligoclase or Orthoclase felspars, occurring as an *acidic igneous* rock. Silica 70 p.c.	G. ± 2.4. *A.* Imbedded. Spherulite, obsidian, Orthoclase, Biotite.
Fr. fine granular, splintery	$(Ce,La,Di,Al)_2(OH)_3$ $CeO(Ca,Fe)(SiO_3)_3$	G. 4.9. Crystals extremely rare. Gelatinizes in HCl. BB infusible, but becomes dirty yellow. With borax in O.F. very dark yellow glass when hot, becoming light yellow on cooling and colorless in R.F. In mercsm. salt, silica. *A.* Actinolite, Orthite, Chalcopyrite.
Fr. conchoidal, compact	$Na_2Al_2Si_{10}O_{24}.3H_2O$ A natural hydrous glass	G. ± 2.2.
Cl. I distinct $I \wedge I$, 87°. *Fr.* broad stalky, fibrous.	$FeCa(SiO_3)_2$	G. 3.5. Weathering. BB fuses easily to bead. *A.* Magnetite, Chalcopyrite, Blende, Pyrite.
.....	$Mg(MgF)PO_4$	G. 3. BB fuses in forceps to greenish-gray glass. Moistened with H_2SO_4 colors flame bluish green. With borax, iron reaction; with soda, effervesces, but not entirely dissolved. With H_2SO_4 gives off HF. Soluble in HCl. *A.* Lazulite, Magnesite, Siderite, Barite.

Hard.

Cl. nearly perfect in three directions. *Fr.* large gran., compact.	$(AlF)LiPO_4$ $(Al.OH)LiPO_4$	G. ± 3.1. In closed tube yields water, which finally, at high heat, becomes acid and corrodes glass. Fuses easily with intumescence, and cools into opaque white. Colors flame yellow-red; with Co solution deep blue. In fine powder dissolves in H_2SO_4. *A.* Lepidolite, Tourmaline, Topaz. In granite.
Fr. granular, compact	$(Al.OH)_2(Mg,Fe,Ca)(PO_4)_2$	G. 3. In closed tube whitens and yields water. Co solution the blue color is restored. BB in forceps whitens, swells, and falls to pieces without fusing, coloring flame bluish green. Unacted on by acids, retaining blue color. *A.* On Quartz veins.

NAME.	LUSTRE.	COLOR.	HARD'SS.	CRYSTAL SYSTEM, HABIT, AND STRUCTURE.
Willemite†	vitreous to resinous	white, gray, pale yellow, pale green, brown, red	5.5	Hex. *H.* r'dl., tetartodrl, acic., columnar. *S.* massive.
Thomsonite† (Comptonit)	vitreous, partly pearly	white	5.5	O'rhm. *H.* cuboid, short acicular. *S.* masv., rounded.
Analcite† (Analcim)	vitreous	white, pale red	5.5	Isom. *H.* ikositdrl., hexhdrl. *S.* massive.
Nosite† (Nosean)	vitreous to resinous	gray, brown, white, black	5.5	Isom. *H.* dodecdrl. *S.* intersp., masv.
Sodalite‡	greasy to vitreous	blue, gray, green, white	5.5	Isom. *H.* dodecdrl. *S.* masv., intersp.
Perofskite‡ (Perowskite)	resinous adamantine sub-metallic	black, brown, red, yellow	5.5	Isom. *H.* cuboid. *S.* intersp., small reniform.
Babingtonite				
Brookite† (Arkansite)	adamantine sub-metallic	red, brown, black	5.5	O'rhm. *H.* thin tab., pyr.
Andesite† (Andesine, Feldspar group)	sub-vitreous inclining to pearly	white, gray greenish yellowish flesh-red	5.5	Trcl. *S.* gran., massive.
Gehlenite‡	greasy	green, brown	5.5	Tetrag. *H.* cuboid, thick tab., short colmn. *S.* interspersed.

CLEAVAGE AND FRACTURE.	CHEMICAL FORMULA.	REMARKS. Sp. Gr., Reactions. A = Associated Minerals.
Cl. i–2 (N. J.) **0** (Moresnet) both easy. *Fr.* fine granular.	Zn_2SiO_4	G. ± 4. Gelatinizes with HCl. BB glows and fuses with difficulty to white enamel. *Ch.* powder with soda gives yellow coating while hot and white on cooling. *A.* Smithsonite, Calamine, Zincite, Franklinite.
Cl. i–ī distinct i–ī less so	$(Al_2(Ca,Na_2)(SiO_4)_2)_2 \cdot 5H_2O$	G. ± 2.3. Gelatinizes with HCl. BB fuses with intumescence to white enamel, losing 13.3 p. c. of water. *A.* Natrolite, Stilbite, Calcite, Elæolite. In cavities in igneous and metamorphic rocks.
Fr. granular	$Al.Na(SiO_3)_2.H_2O$	G. 2.2. Gelatinizes with HCl. Yields water. BB fuses to colorless glass. *A.* Apophyllite, Natrolite, Phillipsite.
Cl. I perfect. *Fr.* granular.	$Al_3Na_3(Al,NaSO_4)(SiO_4)_4$	G. ± 2.3. Gelatinizes with HCl, and emits H_2S odor. BB in forceps fuses to white glass. With soda on coal, hepar reaction with silver. *A.* In trachyte, phonolite, basalt, lava. *Not with Quartz.*
Cl. I perfect. *Fr.* granular, compact.	$Al_3(Al.Cl)Na_5(SiO_4)_4$	G. ± 2.1. Gelatinizes with HCl and HNO_3. In closed tube blue varieties become white and opaque. Fuses with intumescence to colorless glass. *A.* Elæolite, Zircon, Titanite. *Not with Quartz.*
Cl. cubic, distinct	$CaTiO_3$	G. 4. BB in forceps and on coal infusible. Mercsm. salt, greenish bead hot, in O.F., colorless on cooling. R.F. changes to gray-green, and assumes violet tint on cooling. *A.* Chlorite.
Cl. I distinct I ∧ I, 104°	TiO_2	G. ± 4.2. BB infusible. With mercsm. salt, colorless bead, which, in R.F., assumes violet tint on cooling. The Fe impurity obscures the violet unless treated with tin on coal. Insoluble in acids until fused with alkali hydrate or carbonate. Acid solution gives violet color on introduction of tin foil. *A.* Rutile, Anatase, Titanite, Adularia, Quartz, Arkansite; Aplome-Garnet, Elæolite.
Cl. more uneven than Albite. *Fr.* compact.	$Al\,Na\,Si_3SiO_8$ $Al\,Ca\,Si_2AlO_8$	G. 2.68. BB fuses in thin splinters; *Saccharite* only on thin edges. Imperfectly soluble in acids. *A.* Many rocks, especially some trachytes.
Cl. **0** distinct	$(AlO)_2(Ca,Mg,Fe)_3(SiO_4)_2$	G. ± 3. Gelatinizes with HCl. BB thin splinters fuse with difficulty to a gray glass; with borax, slowly to glass colored by Fe. *A.* In granular limestone.

NAME.	LUSTRE.	COLOR.	HARD'SS.	CRYSTAL SYSTEM, HABIT, AND STRUCTURE.
Andalusite (Chiastolite, Hohlspath)	feebly lustrous to earthy	gray, white, pale yellow, pale brown	5.5	O'rhm. *H.* acic., colmn.
Cyanite (Disthene, Rhäticit)	vitreous, partly pearly	blue, less frequently white, pale yellow, pale red, gray, black	± 5.5	Trcl. *H.* colmn., splintery, acic., thick scaly, flat gran. *S.* massive.
Enstatite† (Bronzit, Protobastit)	I pearly	pale gray, pale yellow, pale green, pale brown	5.5	O'rhm. *H.* acic., colmn.
Wernerite† (Scapolite, Mizzonit)	greasy, vitreous, i–i pearly	gray, white, greenish gray, dirty green, reddish gray	5.5	Tetrag. *H.* colmn., acic. *S.* massive.
Ekebergite‡ (Porzellanit, Meionit)	vitreous	white	5.5	Tetrag. *H.* colmn., acic.
Rhodonite† (Kieselmanganerz, Paisbergit, Bustamit, Fowlerite)	vitreous, partly pearly	raspberry-red rose-red reddish brown reddish gray	5.5	Trcl. *H.* short colmn., short acicular. *S.* massive.
Meionite				
Anthophyllite				
Tephroite†	adamant to resinous	brownish gray reddish gray brownish red flesh-red	5.5	O'rhm. *S.* massive.
Beryllonite				
Periclase				
Titanite (Varieties and synonyms: Sphene, Séméline, Greenovite, Lederite, Spinthère, Pictite, Ligurite)	greasy, partly vitreous and adamantine	brown, green, yellow, black; seldom white, red	6	Mcl. *H.* colmn., thin tab., wedge form, chisel form, acic. *S.* massive.
Chloritoid (Chloritspath, Barytophyllit)	vitreous, on cleavage planes pearly	dark green, dark greenish gray	6	Mcl. *S.* massive.

CLEAVAGE AND FRACTURE.	CHEMICAL FORMULA.	REMARKS. Sp. Gr., Reactions. *A* = Associated Minerals.
Cl. I distinct I,∧ I, 91°	$Al(AlO)SiO_4$	G. ± 3.2. BB infusible. With Co solution, blue color. Not decomposed by acids. *A.* In clay slate.
Cl. perfect in one direction, less so in a second (i–ī ∧ iĭ, 106°)	$(AlO)_2SiO_5$	G. 3.6. BB same as preceding. *A.* Staurolite, Almandite and Hessonite or Essonite (Garnets), Omphacite, Hornblende, Corundum.
Cl. I distinct I ∧ I, 88°	$(Mg,Fe)SiO_3$	G. ± 3.2. Weathers. Almost infusible. Only rounded on thin edges. Insoluble in HCl. *A.* Olivine, Apatite. In olivine rock and Serpentine.
Cl. i–i distinct, but interrupted *Fr.* large granular, compact, splintery.	$Al_2(AlCl)Na_4(Si_2O_8)$ $Al_2(AlO)Ca_4(Si_2AlO_8)$	G. ± 2.7. Weathers. Fuses easily with intumescence to white blebby glass. Decomposable by HCl. *A.* Calcite, Magnetite, Augite, Hornblende, brown Titanite, Epidote.
Cl. i–i distinct, but interrupted	$Al_2(AlO)Ca_4(Si_2AlO_8)_3$	G. 2.7. In closed tube yields small amount of water. BB, like preceding. *A.* Sanidine, Nephelite, Augite. On limestone.
Cl. perfect in two direct., I ∧ I, 88°. *Fr.* shelly, gran., compact, splintery.	$MnSiO_3$ $(Mn,Ca)SiO_3$	G. ± 3.5. BB blackens and fuses with slight intumescence. Amethyst glass with borax. *Fowlerite* gives *ch.* with soda reaction for Zn. In powder partially dissolves in HCl, and insoluble portion becomes white. Darkens on exposure to air. *A.* Hausmannite, Braunite, Magnetite, Franklinite, Zincite, Calcite, Pyroxene, Aplome-Garnet.
Cl. perfect in one direction, distinct in another. *Fr.* gran., compact.	Mn_2SiO_4	G. ± 4.6. Gelatinizes without evolving Cl. BB fuses at 3.5 to a black scoria. *A.* Magnetite, Franklinite, Zincite, Calcite.
Cl. I sometimes. *Fr.* shelly.	$CaSiTiO_5$	G. ± 3.5. BB some varieties change color and fuse with intumescence to a yellow, brown, or black glass. With borax, a clear yellowish-green glass. Imperfectly soluble in hot HCl. With tin in concentrated acid, a violet color; with mercesm. salt, in R.F., violet bead masked when Fe is present, if not treated with tin. *A. Sphene* imbedded in clefts of older slates. Albite, Adularia, Chlorite, Rutile. *Séméline* in phonolite, etc. *Brown Titanite* in hornblende slate, syenite, diorite, etc., as also in Magnetite deposits.
Cl. 0 perfect. *Fr.* thin shelly, scaly.	$Al_2(Fe,Mg)H_2SiO_7$	G. ± 3.5. In matrass yields water. BB nearly infusible. Becomes darker and magnetic. *A.* Corundum, Almandite, Chlorite, Amphibole.

NAME.	LUSTRE.	COLOR.	HARD'SS.	CRYSTAL SYSTEI HABIT, AND STRUCTURE.
Diopside (Sahlite, Malakolith. Var. Pyroxene)	vitreous	green, white, yellow	6	Mcl. *H.* colmn., acic splintery, acut pyramidal. *S.* massive.
Leucite	vitreous to resinous	gray, white	6	Isom. and Tetrag. (?) (dimorphic). *S.* interspersed
Tremolite (Grammatite, Calamite, Nephrite or Jade. Variety Amphibole)	vitreous, silky	white, greenish gray	6	Mcl. *H.* colmn., aci *S.* massive.
Omphacite (Allied to Fassaite. Var. Pyroxene)	vitreous	grass-green leek-green	6	Mcl. *S.* massive.
Arfvedsonite				
Diaspore	vitreous i–ĭ pearly	white	6	O'rhm. *H.* tabular, br columnar. *S.* massive.
Turquois† (Callaite, Kallait)	glinting	blue, green	6	Cryptocrystalli *S.* intersp., ma incrusted, lam small reniform
Helvite‡ (Helvin)	resinous	yellow, brown	6	Isom. *H.* tetrahedral.
Hyalite‡ (Var. Opal)	vitreous, seldom pearly	white	6	Amorphous. *S.* small botry small reniform, stalact., incrust

CLEAVAGE AND FRACTURE.	CHEMICAL FORMULA.	REMARKS. Sp. Gr., Reactions. *A* = Associated Minerals.
Cl. I perfect I ∧ I, 87°	$MgCa(SiO_3)_2$ $(Mg,Fe)Ca(SiO_3)_2$	G. ± 3.3. Often many facets. BB with difficulty fusible. Crystal sometimes divided by basal plane into a green and a white half. In clefts of chlorite slate, hornblende slate, and serpentine. *A.* (*Diopside*) Hessonite-Garnet, Chlorite. (*Sahlite*) Magnetite, Pyrite, Chalcopyrite, Blende, Galenite, Calcite, Chlorite.
Cl. icositetrdl.	$AlK(SiO_3)_2$	G. ± 2.5. Crystals always seem isom. BB almost infusible. With Co solution gives blue color. Decomposed by HCl without gelatinizing. In lava, leucitophyr, etc. *A.* Sanidine, Nephelite, Augite, Melanite-Garnet. Seldom imbedded.
Cl. I perfect I ∧ I, 124°. *Fr.* stalky, fibr., radial, felty.	$Mg_3Ca(SiO_3)_4$	G. ± 3.2. Crystals with terminal facets extremely rare. With difficulty fusible. *A.* In the older limestones and dolomites.
Cl. in two directions. In one perfect, in the other distinct. *Fr.* granular.	$Mg,Ca(SiO_3)_2$	G. ± 3.2. BB easily fusible. *A.* Hessonite-Garnet, Hornblende, Cyanite, Saussurite.
Cl. i–ĭ perfect. *Fr.* thin shelly, broad stalky, fibr., radial.	$AlO.OH$	G. ± 3.4. In closed tube decrepitates strongly, separating into pearly white scales, and finally yields water. BB infusible. With Co solution, deep blue. Some varieties react for iron. Not attacked by acids, but after ignition soluble in H_2SO_4. Trichromatic. *A.* (1) Chlorite, Magnetite. (2) In Lithomarge.
Fr. conchoidal to uneven, compact	$Al_2(OH_3)PO_4.H_2O$	G. ± 2.7. Soluble in HCl. In closed tube decrepitates, yields water, and turns brown and black. BB in forceps becomes brown and glassy, but does not fuse. Colors flame green. With borax, in O.F., yellowish-green bead, pure green on cooling. *A.* In Quartz slate.
.....	$(Mn,Be,Fe)_7S(SiO_4)_3$	G. ± 3.2. Decomposed by HCl with evolution of H_2S and separation of gelatinous silica. BB fuses in R.F. to yellowish-brown opaque bead with intumescence. Reacts for Mn. *A.* Aplome-Garnet, Galenite, Blende, Calcite.
Fr. conchoidal	$SiO_2(H_2O)_n$	G. ± 2. Clear as glass and colorless, constituting globular concretions. BB infusible. *A.* In basalt, phonolite, etc.

NAME.	LUSTRE.	COLOR.	HARD'SS.	CRYSTAL SYSTEM, HABIT, AND STRUCTURE.
Spodumene† (Triphane, Hiddenite)	vitreous i–ĭ pearly	gray, white, green	6	Mcl. *H.* columnar. *S.* massive.
Augite (Variety of Pyroxene)	vitreous	grayish and greenish black	6	Mcl. *H.* long and short colmn., acicular, thick tabular. *S.* masv., intersp.
Hypersthene† (Paulit)	vitreous, resinous, i–ĭ metalloid, pearly	blackish brown brownish black i–ĭ copper-red	6	O'rhm. *H.* short acicular. *S.* intersp., masv.
Octahedrite† (Anatase)	adamantine, metalloid in part	in all colors, most frequently red, black; *not white*	6	Tetrag. *H.* pyr., thick tabular, colmn.
Nephelite‡ (Nephelin, Elæolite)	vitreous resinous	white, gray, pale yellow, brown, green, red	6	Hex. *H.* short acicular, short columnar, thick tabular. *S.* masv., intersp.
Orthoclase (Potassium Felspar, Pegmatit, Adularia, Sanidin)	vitreous, 0 generally pearly	white, red, gray, yellow, brown	6	Mcl. *H.* colmn., short acic., tabular, like rhombohedron. *S.* masv., intersp.
Albite (Cleavelandite, Sodium Felspar, Periklin, Hyposklerit)	vitreous 0 pearly	generally white or red	6	Trcl. *H.* colmn, radial, compact. *S.* masv., intersp.
Oligoclase (Calcium-Sodium Felspar. Varieties Aventurine or Sunstone, Moonstone)	resinous 0 vitreous seldom pearly	most frequently green, white, gray, red	6	Trcl. *H.* colmn., thick tabular. *S.* masv., intersp.

CLEAVAGE AND FRACTURE.	CHEMICAL FORMULA.	REMARKS, Sp. Gr., Reactions, A = Associated Minerals.
Cl. i–ī distinct I less so I ∧ I, 87°. *Fr.* broad stalky, thick shelly, compact.	$Al(Li,Na)(SiO_3)_2$	G. 3.1. BB becomes white and opaque; swells up, and gives red color to flame. Fuses to a clear or white glass. Not dissolved by acids. *A.* Tourmaline. In granite.
Cl. i–ī perfect, I and i–ī distinct. *Fr.* compact.	$Al_2O_3.MgAl.SiO_3$	G. ± 3.3. BB with some difficulty fusible to a bead. *A.* In basalt, basalt tufa, dolerite, phonolite, andesite, melaphyre, etc. *Not with Quartz.*
Cl. i–ī distinct. *Fr.* compact.	$(Mg,Fe)SiO_3$	G. ± 3.4. Crystals very rare. BB fuses to a black enamel, and *ch.* yields magnetic mass. *A.* Olivine, Amphibole, Magnetite, Titanite, in Hypersthenite. *Not with Quartz.*
Cl. 0 perfect I distinct	TiO_2	G. ± 3.9. Soluble in HCl. BB infusible. With mercsm. salt, in R.F., bead, which becomes violet on cooling. *A.* Rutile, Titanite, Albite, Adularia, Quartz, Chlorite, Fluorite.
Cl. I distinct 0 distinct. *Fr.* compact.	$Al_8(Na_2,K_2Ca)_4Si_9O_{34}$	G. ± 2.6. Weathers. Gelatinizes with acids. BB fuses quietly to a colorless glass. *A.* In nephelinite, basalt, phonolite, lava, syenite. *Not with Quartz.*
Cl. 0 perfect i–ī distinct. *Fr.* gran., compact, splintery.	$Al(K,Na)Si_3O_8$	G. ± 2.5. Never shows multiple twin striation on 0. Sometimes play of colors. BB fuses with great difficulty. Varieties containing Na are much more fusible. Not acted upon by acids. *A.* Quartz, Muscovite, in granite, gneiss, porphyry, and many rocks. *Seldom or never Pyroxene.*
Cl. 0 perfect i–ī distinct ½ less so. *Fr.* gran., radial, compact.	$Al(Na,K)Si_3O_8$	G. ± 2.6. Often showing multiple twin striation on 0. BB fuses to a colorless or white glass imparting yellow color to flame. *A.* Adularia, Quartz, Smoky quartz, Chlorite, Rutile, Titanite, Pistacite, Apatite. In diorite, granite. In clefts of gneiss and granite.
Cl. 0 perfect i–ī distinct. *Fr.* gran., compact, splintery.	$AlNaSi_2SiO_8$ $AlCaSi_2AlO_8$	G. 2.56. Generally multiple twin striation on 0. BB fuses at 3.5 to a clear enamel. Not affected by acids. *A.* In diabase, granite. In magnetite beds.

NAME.	LUSTRE.	COLOR.	HARD'SS.	CRYSTAL SYSTEM, HABIT, AND STRUCTURE.
Labradorite (Sodium-calcium Felspar)	vitreous to resinous, **0** pearly	white, gray, brown	6	Trcl. *H.* colmn., thick tabular. S. masv., intersp.
Acmite (Aegirite)				
Anorthite (Calcium Felspar, Indianite)	vitreous **0** pearly	white, gray, red	6	Trcl. *H.* short acicular, thick tabular. *S.* masv., intersp.
Microcline **Amazonstone** **Petalite** **Hyalophane**				**5. Very**
Prehnite (Edelite, Jacksonite)	vitreous **0** pearly	green, pale green	6.5	O'rhm. *H.* tabular, short colmn., short acic. *S.* spherical, reniform, botryoidal, massive.
Epidote (Pistacite. Dimorphic with Zoisite)	vitreous pearly in part	green, brown, yellow, gray; seldom red	6.5	Mcl. *H.* colmn., acic. *S.* masv., intersp., lamellar, coating.
Zoisite (Saussurite in part)	vitreous i–ĭ pearly	gray, red, green, white	6.5	O'rhm. *H.* colmn., acic. *S.* massive.
Allanite (Orthite)	vitreous pearly in part	black, dark gray	6.5	Mcl. *H.* colmn., acic., tabular. *S.* masv., intersp.
Chondrodite (Humite) (Klinohumit)	vitreous to resinous	yellow, brown	6.5	Mcl. ***Humite*** O'rhm. *S.* masv., intersp.

CLEAVAGE AND FRACTURE.	CHEMICAL FORMULA.	REMARKS. Sp. Gr., Reactions. *A* = Associated Minerals.
Cl. 0 perfect i–ĭ less so. *Fr.* gran., compact, splintery.	$AlNaSi_2SiO_8$ $AlCaSi_2AlO_8$	G. ± 2.7. Crystals rare. On 0 generally multiple twin striation and beautiful play of colors. BB fuses to colorless glass. Decomposed with difficulty by HCl, and generally but partially. *A.* In basalt, gabbro. *Not* with Quartz nor Muscovite.
Cl. 0 perfect i–ĭ perfect. *Fr.* gran., compact.	$AlCaSi_2AlO_8$	G. ± 2.76. Crystals generally small and with many facets. BB fuses to colorless glass. From Mt. Somma decomposed by HCl with separation of silica. *A.* In gran. limestone.

Hard.

Cl. 0 perfect I distinct I ∧ I, 100°. *Fr.* radial, gran.	$Al_2Ca_2H_2(SiO_4)_3$	G. ± 2.8. Decomposed by HCl without gelatinizing. In closed tube yields water. BB fuses with intumescence to blebby enamel-like glass. *A.* Calcite, Datolite.
Cl. perfect in one direction; less so in another	$Al_2(Al.OH)Ca_2(SiO_4)_3$	G. 3.2–3.5. Partially decomposed by HCl, but when first ignited gelatinizes with acid. In closed tube generally gives water. BB fuses with intumescence to dark brown or black mass, which is generally magnetic. Reacts for Fe and sometimes for Mn with fluxes. *A.* (1) In clefts of hornblendic rocks. (2) Chlorite slate. (3) The older limestone and magnetite beds. (4) In clefts and amygdaloids of melaphyre.
Cl. perfect in one direction. *Fr.* stalky.	$Al_2(Al.OH)Ca_2(SiO_4)_3$	G. ± 3.2. Crystals generally without terminal planes. Not decomposed by acids. Previously ignited gelatinizes with HCl. BB swells up and fuses to white blebby mass. *A.* Hornblende, Hessonite garnet, Epidote, Cyanite.
Fr. compact, conchoidal	$(Al,Ce,Fe)_2(Al.OH)(Ca,Fe)_2(SiO_4)_3$	G. 3–4.2. Most varieties gelatinize with HCl. Some varieties give water in closed tube. BB fuses easily, and swells to a dark blebby magnetic glass. With fluxes reacts for iron. *A.* Magnetite. Hessonite. On granite, syenite, trachyte. In the older limestones.
Fr. granular	$(Mg.OH)_2(MgFl)_4(Mg,Fe)_{12}(SiO_4)_8$	G. ± 3.1. Crystals generally small and with many facets. Gelatinizes with acids. BB infusible. Some varieties blacken and then burn white. Fused with mercsm. salt, in open tube, reacts for F; with fluxes, reaction for Fe. *A.* Magnetite, Blende, Chalcopyrite, Galenite, Spinel, Amphibole, Biotite, Graphite. In deposits of the older limestones.

NAME.	LUSTRE.	COLOR.	HARD'SS.	CRYSTAL SYSTEM, HABIT, AND STRUCTURE.
Rutile (Ilmenorutile)	adamantine	red, brown	6.5	Tetrag. *H.* colmn., acic., capillary. *S.* masv., intersp.
Piedmontite				
Cassiterite (Zinnerz)	adamantine resinous	black, gray, brown. Seldom yellow, red, white	6.5	Tetrag. *H.* colmn., acic., pyramidal. *S.* masv., intersp.
Bertrandite				
Melanophlogite				
Fibrolite (Sillimanite). Dimorphic with Cyanite	resinous vitreous	gray, brown, green	6.5	O'rhm. *H.* acic., colmn. *S.* massive.
Gadolinite				
Peridot (Olivine, Chrysolite)	vitreous resinous	green, yellow, brown	7	O'rhm. *H.* short acicular, short colmn., tab. *S.* masv., intersp.
Tridymite				
Obsidian (Including Pumice, Volcanic Glass). A rock	vitreous seldom silky	black, gray, white, brown	7	Amorphous
Zunyite				
Quartz (Silex, Kiesel)	vitreous; on surfaces of fracture resinous	in all colors; mostly white and gray	7	Hex. *H.* colmn., acic., pyr., seldom r'dl. *S.* masv., intersp., lamel., incrust'ns.
Dumortierite				
Chalcedony (Flint. Varieties of Quartz)	on planes of fracture glinting to earthy	in all colors, and frequently many in the same specimen	7	Cryptocrystalline. *S.* reniform, stalactitic, globular, botrydl., nodular, lamel., incrust'ns.
Vesuvianite† (Idocrase)	resinous, partly vitreous	brown, gray, yellow; seldom red	7	Tetrag. *H.* colmn., acic., tabular, pyr. *S.* massive.

CLEAVAGE AND FRACTURE.	CHEMICAL FORMULA.	REMARKS. Sp. Gr., Reactions. A = Associated Minerals.
Cl. i–i perfect I distinct. *Fr.* compact, gran.	$TiTiO_4$	G. ± 4.2. BB infus. With mercsm. salt colorless bead, which, in R.F., becomes violet on cooling. *A.* (1) In the older slates. (2) In clefts of latter. Titanite, Adularia, Albite, Quartz, Chlorite. (3) In deposits of Apatite, Magnetite.
Cl. i–i perfect I distinct. *Fr.* compact, gran., fine fibrous.	SnO_2	G. 6.4–7.1. Generally in twins. But slightly acted upon by acids. BB alone unaltered. With soda in R.F., white coat. *A.* (1) In the older slates and old eruptive rocks. (2) In tin veins. Arsenopyrite, Wolframite, Scheelite, Molybdenite, native Bismuth, Fluorite, Apatite, Lepidolite, Chlorite. (3) Deposits of Pyrite, Blende, etc. Aplome-Garnet, Pyroxene.
Cl. i–i perfect. *Fr.* fibr., compact, splintery.	$Al(AlO)SiO_4$	G. ± 3.2. Not decomposed by acids. BB infusible. With Co solution gives a blue color. *A.* Cordierite, Zircon. In gneiss.
Cl. distinct in two directions. *Fr.* gran., compact.	$(Mg,Fe)_2SiO_4$	G. ± 3.4. Decomposed and gelatinizes with HCl and H_2SO_4. BB whitens, but is infusible. With fluxes gives reactions for Fe. Some varieties give reaction for Ti and Mn. (1) Occurs as a rock. (2) In basalt, gabbro, talc slate. *A.* Biotite, Bronzite, Hypersthene, Diallage, Garnet, and Magnetopyrite. *Not with Quartz.*
Fr. conchoidal, compact, porous	$KNa_3Al_2Si_{10}O_{25}$	G. 2.25–2.8. Principally Orthoclase in glassy state. Sometimes a mixture of Orthoclase, Labradorite, and Augite with Chrysolite and much iron. Splinters exceedingly sharp edged. Very brittle. BB difficult to fuse to bead. Occurs as a rock, and *A.* Perlite.
Cl. R very seldom distinct. *Fr.* conchoidal, compact, splintery, stalky, fibr., gran.	SiO_2	G. ± 2.7. Generally horizontal striations on I. BB alone unaltered. With soda dissolves with effervescence. Unacted upon by mercsm. salt. Soluble only in HF. *A.* Very widely distributed.
Fr. in the large, even to conchoidal; in the small, fine splintery	SiO_2	G. ± 2.7. BB, see Quartz. Either transparent or translucent. *A.* (1) In clefts and rounded cavities of Melaphyre. Quartz, Zeolites, Calcite. (2) In ore veins. (3) Deposits of Siderite and Limonite. (4) Flint in chalk.
Fr. stalky, gran., compact, splintery	$Al_{12}Ca_{24}(OH)_{10}Si_{20}O_{77}$	G. ± 3.4. Crystals often show many facets. BB fuses with intumescence to a greenish or brownish glass. With fluxes gives iron reaction. After ignition completely decomposed by HCl. *A.* In older limestones and deposits of Magnetite, Pyrite, Magnetopyrite, Blende, Galenite, Pyroxene, Aplome-Garnet, Chlorite, Biotite.

NAME.	LUSTRE.	COLOR.	HARD'SS.	CRYSTAL SYSTEM HABIT, AND STRUCTURE.
Garnet (Carbunculus. Varieties: Grossularite Ca-Al garn., Pyrope Mg-Al garn., Almandite Fe-Al garn., Spessartite Mn-Al garn., Andradite (or Aplome) Ca-Fe garn., Bredbergite Ca-Mg-Fe garn., Uwarowit Ca-Cr garn.)	vitreous resinous	in all colors *but blue;* most frequently red, brown, green, black	7	Isom. *H.* dodecahedra icositedrahedral *S.*
Axinite‡ (Thumite)	vitreous, partly adamantine	brown, gray	7	Trcl. *H.* tabular. *S.* massive.
Tourmaline (Schörl. Var. I. is brown. Var. II. is red)	vitreous	in all colors; principally black brown, and green	7	Hex. *H.* r'dl., colmn., acicular. *S.* masv., inters
Iolite‡ (Cordierite, Dichroite)	vitreous resinous	blue, green, gray, brown	7	O'rhm. *H.* columnar. *S.* masv., interst
Boracite‡ (Parasit, Stasfurtit). Dimorphic	vitreous adamantine	white, gray, greenish	7	Isom. and O'rhr *H.* hexdrl., dodc tetrdl.
Danburite				
Andalusite† (Chiastolite). Dimorphic with Cyanite	vitreous resinous	red, gray, brown	7	O'rhm. *H.* colmn., acic. *S.* massive.
Staurolite† (Granatite, Staurotide)	vitreous	reddish brown black-brown black	7.5	O'rhm. *H.* colmn., acic.

CLEAVAGE AND FRACTURE.	CHEMICAL FORMULA.	REMARKS. Sp. Gr., Reactions. *A* = Associated Minerals.
Fr. compact, splintery, granular	Ca-Al G.–$Al_2Ca_3(SiO_4)_3$ Ca-Fe " $Fe_2Ca_3(SiO_4)_3$ Ca-Cr " $Ca_3Cr_2(SiO_4)_3$ Fe-Al " $Al_2Fe_3(SiO_4)_3$	G. 3.1–4.3. Most varieties fuse easily to light-brown or black glass. Almost all varieties react for Fe. The other reactions vary with the bases. Almost all are decomposed after ignition by HCl, and usually with separation of gelatinous silica. *A.* Almandite, Spessartite in the older slates and in granite. Melanite in basalt, nephelinite, Leucitite, etc. Aplome in deposits of Magnetite, Pyrite, Blende, Galenite, etc. Pyrope in Serpentine. Grossularite (Hessonite) in older limestones, imbedded in older slates, constituent of Eklogite; in deposits of Magnetite.
Fr. shelly	$H_2(Ca,Fe,Mn)_4$ $BO(Al,Fe)_3(SiO_4)_5$	G. ± 3.3. Not decomposed by acids. Gelatinizes with HCl. Fuses easily with intumescence, and imparts pale green to flame, and fuses to dark-green to black glass. With borax an amethyst-colored bead in O.F. Fused with $KHSO_4$ and fluorite on platinum wire gives green flame. *A.* In clefts of Hornblende slate, diorite, etc. In deposits of Blende, Arsenopyrite, etc.
Fr. conchoidal, stalky, fibr., gran.	$(Mg,Fe,Na_2,Li_2,H_2$ $(AlO)_2)_9Si_4B_2O_{20}$	G. 2.9–3.3. Dichroic. Pyroelectric. Rubellite infusible, but becomes paler. Not decomposed by acids. BB most varieties fuse with intumescence, and give reaction for Fe and Mn, and with mixture of $KHSO_4$ and CaF_2 strong reaction for boracic acid. After fusion perfectly decomposed by H_2SO_4 and gelatinizing with HCl. *A.* Almandite, Beryl, Topaz. In older slates. In and on granite.
Cl. 0 distinct i–ī distinct. *Fr.* compact.	$(Al,Fe)_6Mg_3Si_8O_{28}$	G. ± 2.6. Only partially decomposed by acids. BB loses transparency and fuses. *A.* Almandite, Schörl. In gneiss, granulite, granite.
Cl. of isom. octdl. in traces. *Fr.* conchoidal.	$Mg_7Cl_2B_{16}O_{30}$	G. ± 3. Massive variety gives water in closed tube. BB fuses to white crystalline pearls, coloring flame green. With Co solution assumes deep-pink color. Mixed with CaO and heated on coal gives flame deep-blue color. *A.* Gypsum, Anhydrite.
Cl. I perfect I ∧ I, 91°. *Fr.* stalky, fibrous, compact, splintery.	$Al(AlO)SiO_4$	G. ± 3.1. Weathering. BB infusible. With Co solution, a blue color. Not decomposed by acids. *A.* Almandite, Tourmaline, Rutile. In the older slates, granite.
Cl. i–ī distinct	$(AlO)_4Fe(AlOH)(SiO_4)_2$	G. ± 3.6. Often in twins. BB infusible, except the Mn variety, which fuses to a black magnetic glass. With fluxes reacts for Fe and sometimes for Mn. Imperfectly decomposed by H_2SO_4. *A.* Almandite, Cyanite. In mica slate.

NAME.	LUSTRE.	COLOR.	HARD'SS.	CRYSTAL SYSTEM, HABIT, AND STRUCTURE.
Beryl† (Emerald)	vitreous	green, blue, white, yellow, red	7.5	Hex. *H.* colmn., acic. *S.* massive.
Euclase				
Zircon† (Hyacinth)	adamantine resinous	colorless, and in all colors, especially brown, yellow, and gray	7.5	Tetrag. *H.* colmn., acic., pyramidal. *S.* interspersed.
Gahnite				
Phenacite				
Chrysoberyl† (Alexandrite)	vitreous resinous	green, yellow	8	O'rhm. *H.* thick tabular, short colmn., pyr. *S.* interspersed.
Spinel† (Picotite)	vitreous resinous	black, red, green, blue, brown	8	Isom. *H.* octahedral. *S.* interspersed.
Topaz (Topazius, Pyrophysalite, Physalite, Pycnite)	vitreous, adamantine, and on **0** pearly	yellow, pale blue, white, pale green, pale red	8	O'rhm. *H.* colmn., acic. *S.* intersp., masv.
Corundum† (Ruby, Sapphire)	vitreous resinous	blue, red, green, gray, brown, white	9	Hex. *H.* colmn., thick tab., pyr., rhmbdl. *S.* masv., intersp.
Diamond† (Adamas)	adamantine	in all colors, most frequently white, gray, yellowish, brownish	10	Isom. *H.* octdrl., dodcl., hexhdrl. *S.* masv., intersp., seldom globular.

CLEAVAGE AND FRACTURE.	CHEMICAL FORMULA.	REMARKS. Sp. Gr., Reactions. *A* = Associated Minerals.
Cl. **0** distinct I less so. *Fr.* stalky.	$Al_2Be_3(SiO_3)_6$	G. ± 2.7. BB unchanged or becomes clouded. Glass with borax, clear for beryl; fine green for emerald. Slowly soluble with mrcsm. salt without leaving siliceous skeleton. Undissolved by acids. *A.* Tourmaline, Topaz, Triphyline. In mica slate, chlorite slate, and in granite. In tin ore veins.
Cl. I distinct. *Fr.* compact.	$ZrSiO_4$	G. 4–4.7. Infusible. The colorless varieties are unaltered; the red becomes colorless. Not perceptibly attacked by mrcsm. salt. Powder is decomposed by fusion with soda on platinum wire, and if the product is dissolved in dilute HCl, gives the characteristic orange color with turmeric paper. *A.* In eruptive rocks, both the older granite, syenite, and the newer basalt. In clefts of the older slates with Diopside, Garnet, Chlorite.
Fr. compact	$BeAl_2O_4$ or $Be(AlO_2)_2$	G. ± 3.7. Crystals often seem hex. Insoluble in acids. BB alone unaltered. With soda the surface is merely rendered dull. With borax or mrcsm. salt fuses with great difficulty. With Co solution the powder gives a bluish color. *A.* Beryl, Phenacite, Almandite, Tourmaline. In mica slate and granite.
Fr. compact	$MgAl_2O_4$ or $Mg(AlO_2)_2$	G. 3.5–4.9. Sometimes in twins. BB alone infusible. Red variety changes to brown or black, and becomes opaque. On cooling becomes green, then nearly colorless, and finally resumes its red color. Slowly soluble in borax and mrcsm. salt, with which it gives reddish bead, becoming green by cooling. Soluble with difficulty in H_2SO_4. *A.* Pyroxene, Chondrodite, Biotite, Graphite. In the older limestones. In basalt and talc slate.
Cl. **0** perfect. *Fr.* stalky.	$Al(Al(F_2O))SiO_4$	G. ± 3.5. BB infusible. Some varieties take a wine-yellow or pink tinge when heated. Fused in open tube with mrcsm. salt gives reaction for F. With Co solution the powder gives fine blue. Only partly attacked by H_2SO_4. *A.* In tourmaline slate, in and on granite. On tin ore deposits.
Cl. R distinct **0** distinct. *Fr.* gran., compact, splintery.	Al_2O_3	G. ± 4. BB unaltered. Slowly dissolved in borax and mrcsm. salt to a clear glass, which is colorless when free from iron. Not acted upon by soda. Finely powdered mineral gives blue color with Co solution. Not acted upon by acids. Friction develops electricity. *A.* In independent deposits. Magnetite, Chlorite. In older limestones and granite. In basalt.
Cl. 1 highly perfect	C	G. 3.5. Crystals often rounded. Burns to CO_2. Is not acted upon by acids or alkalies. Almost always loose. In washings, with decomposed Peridot.

NAME.	COLOR.	STREAK.	LUSTRE.	HARD'SS.	TENACITY.
Acmite (Aegirite)	black, blackish green, reddish brown	pale yellowish gray	vitreous, inclining to resinous	6	brittle
Aguilarite ‡	iron-black	.....	metallic, brilliant	2.5	sectile
Aikinite (Nadelerz Patrinite)	black, red, gray, with pale copper-red tarnish	.....	metallic	2.25	.....
Allactite	brownish red	brownish gray	vitreous, on frac. greasy	4.5	.....
Allemontite	tin-white to reddish gray, often tarnished brownish black	.....	metallic, sometimes dull	3.5	.....

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CRYSTAL SYSTEM, HABIT, AND STRUCTURE.	CLEAVAGE AND FRACTURE.	CHEMICAL FORMULA.	REMARKS. Sp. Gr., Reactions. *A* = Associated Minerals.
Mcl. *H.* tabular, acute pyramidal.	*Cl.* I. *Fr.* uneven.	$NaFe(SiO_3)_2$	G. 3.5. BB (*ch.*) fuses at 2 to lustrous black magnetic globule, coloring flame yellow. With fluxes Fe and sometimes Mn reaction. Slightly acted on by acids; sometimes altered to Analcite. *A.* Pegmatite, Quartz, Leucophanite, Cancrinite, Elæolite, Augite, Sodalite, Eudialite, Arfvedsonite.
Isometric	*Cl.* none. *Fr.* hackly.	$(Ag_2)_2SeS$	G. 7.59. Heated slowly in the open tube yields metallic silver, SeO_2, SO_3, and some silver sulphate. *A.* From San Carlos mine, Guanajuato.
Orthrhm. *H.* interspersed crystals acic., longit. striated. *S.* also massive.	..... *Fr.* uneven	$(PbBiCuS_3)_2$	G. 6.1 to 6.8. In open tube SO_2 and white subl. fusible into clear drops, white on cooling; assay surrounded with black fused oxide, which is transparent and greenish yellow on cooling. BB (*ch.*) fuses with white coating, yellow on edge nearest assay. With fluxes reaction for Cu, and after a time button of Cu. *A.* Gold, Malachite, and Galena in white Quartz.
Mcl. *H.* small prismatic. Tabular. Vertically striated. *S.* also embedded.	*Cl.* $\pm$ m-ī	$Mn_3.4Mn(HO)_2(AsO_4)_2$	G. 3.84. BB nearly infusible. Reacts for As and Mn. Loses water and becomes black at low red heat. Easily soluble in acids. *A.* With other Mn arsenates, Magnetite, Hausmannite, Pyrochroite, Fluorite, and manganiferous Barite.
Hex. Rbdrl. *H.* ren., am'rph. *S.* curved lam., fine gran.	.....	$SbAs_3$	G. 6.02. BB emits fumes of As and Sb, and fuses to a metallic globule, which ignites and burns away, leaving Sb_2O_3 on the charcoal. *A.* Arsenolite, Calcite, and Quartz.

NAME.	COLOR.	STREAK.	LUSTRE.	HARD'SS.	TENACITY.
Amarantite (Hohmannite)	orange, brownish, or amaranth red	lemon yellow	.....	2.5	brittle
Amazonstone (See Microcline)					
Anthophyllite	brownish gray, brownish green, emerald-green	grayish	vitreous to pearly	5.3	.....
Arfvedsonite (Arfwedsonit)	pure black, in thin scales deep green	deep bluish gray	vitreous	6	brittle
Argyrodite	steel-gray with tinge of red	grayish black	metallic	2.5	somewhat brittle
Arseniopleite	brownish red	yellowish brown	.....	.....	.....

CRYSTAL SYSTEM, HABIT, AND STRUCTURE.	CLEAVAGE AND FRACTURE.	CHEMICAL FORMULA.	REMARKS. Sp. Gr., Reactions. *A* = Associated Minerals.
Trcl. *H.* slender pris. with faces vertically striated. *S.* in colmn. or bladed masses. Also radiated.	*Cl.* { i–ī. i–ī. perfect.	$Fe(OH)SO_4.(H_2O)_3$	G. 2.11. The fine powder is gradually decomposed by cold water, forming a basic insoluble salt. *A.* From a vein of argentiferous lead ores with Sphalerite, Chalcopyrite, Atacamite.
Orthrhm. *H.* columnar, prisms not ter. *S.* usually lam. or fibrs. masv. Also in aggrns. of prisms like actinolite.	*Cl.* prismatic, perfect. *Fr.* stalky, fibrous.	$Mg.Fe.(SiO_3)$	G. 3.15. Transparent to subtranslucent. Unacted upon by acids. BB fuses with difficulty to a black magnetic enamel. With fluxes gives reaction for iron. *A.* In mica schist with Hornblende and Mica.
Mcl. *H.* colmn. pris. seldom term'd. *S.* in aggreg'ns of prisms.	*Cl.* prismatic, perfect. *Fr.* uneven.	$(Fe,Mg,Na_2,Ca)_4$ $(SiO_3)_4$	G. 3.45. Not acted on by acids. BB fuses easily with intumescence to a black metallic globule. Colors flame yellow. *A.* Sodalite, Eudialite, Feldspar, Augite, Elæolite, Quartz, Aegirite.
Mcl. *H.* twins geniculated. Also trillings. *S.* crystals indistinct. Reniform, grouped.	*Fr.* uneven to flat conchoidl.	$(Ag_2S)_3.GeS_2$	G. 6.085. In closed tube gives a brilliant black sublimate; in the open tube fumes of SO_3. BB (*ch.*) fuses to a bead, giving silver button, and near the assay faint white, farther off orange-yellow sublimate. *A.* Siderite, Marcasite, Sphalerite, Pyrite, Galena, Argentite, Pyrargyrite, Polybasite, Stephanite. Interspersed sometimes on Argentite, Marcasite, or Siderite.
Hex. (rhmbdl.) *H.* massive. *S.* lamellar.	*Cl.* rhmbdrl	$(Mn,Fe)_2$ $(Mn,Ca,Pb,Mg)_3$ $(MnOH)_6(AsO_4)_6$	G. ——. Transparent or blood-red in thin leaves. Easily soluble in HCl. Decrepitates. BB (*ch.*) fuses easily, leaving black slag, giving arsenical fumes and a trace of a lead sublimate. *A.* Rhodonite in crystalline limestone.

NAME.	COLOR.	STREAK.	LUSTRE.	HARD'SS.	TENACITY.
Astrophyllite	bronze-yellow to gold-yellow, powder like mosaic gold	mosaic gold	submetal., pearly	3	brittle
Babingtonite	dark greenish black	.....	vitreous, splendent	5.5	brittle
Bastnäsite (Hamartite)	wax-yellow to reddish brown	light yellowish gray	vitreous to greasy	4.5	.....
Beegerite	light to dark gray	.....	metallic, brilliant	.....	.....
Bertrandite	colorless to slightly yellow	.....	vitreous, pearly on **0**	6.5	.....
Beryllonite	colorless, white, or pale yellowish	.....	vitreous, on **0** pearly	5.75	brittle

ıL SYSTEM, ɜIT, AND UCTURE.	CLEAVAGE AND FRACTURE.	CHEMICAL FORMULA.	REMARKS. Sp. Gr., Reactions. *A* = Associated Minerals.
hm. ,t prisms, ·like. ɔasionally ɜe.	*Cl.* i–ĭ perfect	$(K,Na)_2H_4(Fe,Mn,Ca,Mg)_5(Zr,Si,Ti)_7O_{22}$	G. 3.35. Translucent in thin leaves; strong pleochroism. Decomposed by strong HCl with separation of silica in scales. BB swells up and fuses easily to a black magnetic enamel. Strong Mn reaction with soda and borax. *A.* In Zircon syenite, in lam. Feldspar, Leucophanite, Natrolite, Catapleite, Aegirite, Mica, Arfvedsonite.
ıall indi- l crystals	*Cl.* 'I perfect. *Fr.* subconchoidal.	$(Ca,Fe,Mn)SiO_3$	G. 3.36. Pleochroic. Faintly translucent. Not acted on by acids. BB fuses in coarse fragments to a black magnetic globule, and with fluxes gives reactions for Fe and Mn. *A.* Epidote and massive Garnet, in syenite and granite.
(?) ismatic omorphs. ıssive.	.....	$[(Ce,La,Di)F]CO_3$	G. 4.93. Slightly attacked by HCl. Dissolves in strong H_2SO_4 with effervescence, liberating CO_2 and HF. *A.* From emerald mines.
ɜtric	*Cl.* cubic	$Pb_6Bi_2S_9$	G. 7.273. Opaque. Dissolved slowly by cold and quickly by warm HCl. SO_2 in open tube. BB (*c/i.*) fuses to globule giving Pb and Bi coatings. *A.* Tennantite, Quartz, Chalcocite, Bornite.
hm. ·ins. ɔular.	*Cl.* I perfect	$Be_2(BeOH)_2Si_2O_7$	G. 2.6. Pyroelectric on cooling. On O +, on the rounded face—. The water driven off only at red heat. Insoluble in acids. BB infusible but becomes opaque. *A.* On Quartz and Feldspar in cavities of Pegmatite veins in gneiss, also in cavities in Beryl.
hm.	*Cl.* O perfect. *Fr.* conchdl.	$BeNaPO_4$	G. 2.84. Slowly but completely dissolved in hot acids. BB decrepitates and fuses in coarse fragments to a slightly clouded glass, coloring flame deep yellow with a green streak on the lower edge. *A.* Feldspars, smoky Quartz, Beryl, Columbite in disintegrated granite.

NAME.	COLOR.	STREAK.	LUSTRE.	HARD'SS.	TENACITY.
Berzeliite (Pyrrharsenite) (Pyrrhoarsenit)	yellow to red	white to orange-yellow	resinous	5	brittle
Bindheimite (Bleiniere)	white, gray, brownish, yellowish	white to grayish or yellowish	resinous	4	.....
Binnite	dark steel-gray to iron-black	reddish brown	metallic	2.75	brittle
Bismite (Bismuthocker)	greenish yellow to grayish white	.....	adamant. to dull earthy	.....	pulverulei
Calaverite †	pale bronze-yellow	yellowish gray	metallic	2.5	brittle
Cancrinite	white, gray, yellow, green, blue, reddish	colorless	subvitreous	5.5	.....

ıL SYSTEM, ЭIT, AND UCTURE.	CLEAVAGE AND FRACTURE.	CHEMICAL FORMULA.	REMARKS. Sp. Gr., Reactions. *A* = Associated Minerals.
tric. ·ely in o- ns. ıerally ·e.	*Cl.* none. *Fr.* subconchoidal.	$(Ca,Mg,Mn,Na_2)_3(AsO_4)_2$	G. 4.08. Soluble in nitric acid. BB fuses easily to a black bead, if rich in Mn. Other varieties less easily to gray or brown. BB *ch.* with soda gives arsenic odor. On plat. foil with soda fuses with effervescence, and gives Mn reaction. *A.* With iron ore and gran. limestone, Braunite, Hausmannite.
phous. ıiform, ɔidal. ıetimes . lam'llar.	.....	$Pb_3Sb_2O_8.(H_2O)_4$	G. 4.70. In closed tube yields water. BB *ch.* reduced to metallic globule of PbSb coating, yellow near assay, and white further off. *A.* Jamesonite, Bournonite.
tric. ·trahed. .) ıplex also ·e.	*Cl.* indistinct. *Fr.* conchoidl.	$Cu_6As_4S_9$	G. 4.47. In closed tube subl. of As_2S_3. Open tube, crystalline As_2O_3, with SO_2. BB *ch.* arsenic odor and faint white coating, fusing with intumesence to a dull iron-black globule, which yields metallic copper with soda. *A.* With Realgar, Orpiment, Sphalerite, Pyrite, Sartorite, and Dufreynoysite in crystalline dolomite.
hm. (?) ·tificial) ıtic. ·tural) dissem-, passing ɔliated.	*Fr.* conchoidl to earthy	Bi_2O_3	G. 4.361. Sol. in HNO_3. Closed tube, most specimens give off water. BB *ch.* fuses and is easily reduced to metallic Bi, which in O. F. gives yellow coating. *A.* Native Gold.
inctly lline. ssive.	*Fr.* uneven to subconchoidl	$(Au,Ag)Te_2$	G. 9.04. Dissolves in aqua regia in the separation of silver chloride. BB *ch.* fuses with a bluish-green flame, yielding buttons of very yellow gold. *A.* Petzite, Sylvanite, and Quartz.
;onal. ·ely prisms with obterminal ids. ally mas-	*Cl.* prismatic, perfect	$(Na_2,Ca)_4H_6(NaCO_3)_2Al_6Si_9O_{36}$	G. ± 2.45. Transparent to translucent. Effervesces with HCl, and on heating forms a jelly. BB loses color and fuses easily (2) with intumescence to a white blebby glass. Fusibility distinguishes it from Nephelite. *A.* Zircon, Calcite, and Magnetite, in coarse granite. Whitish, pale yellowish, less often blue, with blue Sodalite, and Bergmannite.

NAME.	COLOR.	STREAK.	LUSTRE.	HARD'SS.	TENACITY
Castanite	chestnut-brown	orange-yellow	vitreous brilliant	3	.....
Celadonite (Seladonit) (Grünerde)	deep olive green, celandine or apple green	deep green	dull	1.5	mild
Cervantite (Antimonocker)	Isabella yellow to reddish white	yellowish white to colorless	greasy, pearly, earthy	4.5	soft and friable
Childrenite (Eosphorite)	yellowish white, brown, brownish black	colorless to yellowish	vitreous to resinous	4.5	.....
Chiolite	snow-white	.....	vitreous	3.75	.....
Clinochlore (Chlorite group)	deep grass, olive, pale green, yellowish, rose, or white	greenish white to colorless	cl. surf. somewhat pearly	2.25	mild, flexible in thin plates
Colemanite	colorless, milky-white, gray	colorless	vitreous to adamantine	4.25	.....

AL SYSTEM, BIT, AND UCTURE.	CLEAVAG AND FRACTURE	CHEMICAL FORMULA.	REMARKS. Sp. Gr., Reactions. *A* = Associated Minerals.
ismatic. ssive, also ıg cavit's.	.....	$Fe_2S_2O_9.(H_2O)_8$	G. 2.118. Slightly soluble in water. Dissolves in warm HCl. Does not lose water by exposure to air or over $CaCl_2$. *A.* Copiapite, Barite.
ıorphous. ıssive.	*Fr.* uneven, earthy	Fe,Al,K,Mg,Si,O (No formula obtained)	G. 2.85. Not acted on by HCl. *A.* From cavities in Amygdaloid.
hm. (?) ic. crystal. assive as or powdr.	*Fr.* uneven and earthy	$Sb.SbO_4$	G. 4.084. Soluble in HCl. BB infusible and unaltered. *Ch.* easily reduced. *A.* Stibnite and other Sb minerals.
hm. rmdl.; imes e pyr.; ısmatic. ıssive.	*Cl.* i–ī. *Fr.* uneven.	$Al(OH)_2(Fe,Mn,Ca)PO_4.H_2O$	G. 3.21. Translucent, known only in crystals. Closed tube yields water. Soluble in HCl. BB swells into ramifications, fuses on edges to black mass, coloring flame green. *Ch.* becomes black and magnetic. With borax, reaction for Fe and Mn. *A.* Siderite, Pyrite, Quartz, and sometimes Apatite.
gonal. ıall pyrm. asv. gran. ılline.	*Cl.* pyram.	$(AlF_3)_2.(NaF)_5$	G. ± 2.86. Transparent to translucent. BB. (See Cryolite.) *A.* Cryolite, Topaz, Fluorite, Phenacite.
ıxagonal, ar, trian-, rhbhdrl. ırse, scaly, to earthy.	*Cl.* 0 perfect. *Fr.* across laminæ, uneven.	$H_8(Al,Fe,Cr)_2(Mg,Fe)_5Si_3O_{18}$	G. 2.7. Transparent to translucent. Pleochroism not strong in green varieties. Wholly decomposed in H_2SO_4. BB in plat. forceps whitens and fuses with difficulty on edges to a grayish-black glass. With borax a clear glass colored by Fe and sometimes Cr. *A.* In chloritic and talcose Rocks and Serpentine with Biotite, Phlogopite.
ort pris. ısv., cleav. nular and act.	*Cl.* i–ì highly perfect, 0 distinct. *Fr.* uneven to subconchoidl.	$Ca_2B_6O_{11}.(H_2O)_5$	G. 2.417. Transparent to translucent. Soluble in hot HCl with separation of boric oxide. BB decrepitates, exfoliates, sinters, and fuses imperfectly, coloring flame yellowish green. *A.* Quartz, Strontianite.

NAME.	COLOR.	STREAK.	LUSTRE.	HARD'SS.	TENACITY.
Coloradoite (Tellurqueck-silber)	iron-black to gray	.....	metallic	3	.....
Columbite (Tantalite) (Niobit)	iron-black, brownish black, opaque	dark red to black	sub-metal.; brilliant sub-resinous	6	brittle
Connarite (Konarit)	yellowish, pistachio, siskin, olive-green	siskin-green	common mother-of-pearl	2	brittle
Coquimbite (White Cop-peras)	whitish, yellowish, brownish, greenish, violet	.....	.....	2.25	.....
Cotunnite	white, yellowish, greenish	colorless	adamant. inclining to pearly	2	soft

CRYSTAL SYSTEM, HABIT, AND STRUCTURE.	CLEAVAGE AND FRACTURE.	CHEMICAL FORMULA.	REMARKS. Sp. Gr., Reactions, *A* = Associated Minerals.
(?) *S.* masv. gran.	*Cl.* none. *Fr.* uneven to subconchoidl.	HgTe	G. 8.627. Soluble in HNO_3. In tube, decrepitates, fuses, and yields metallic Hg as sublimate, next TeO_2 in drops and metallic Te closest to assay. *A.* Native Gold, Tellurium, Quartz, and Sylvanite.
Orthrhm. *H.* short pris. *S.* large groups of parallel crystals and masv.	*Cl.* i–ī distinct. *Fr.* subconchoidal to uneven.	$Fe[(Nb,Ta)O_3]_2$	G. 6.3. Rarely translucent, frequently iridescent. Fused with $KHSO_4$ gives with dilute HCl a yellow solution and heavy white powder, which on addition of Zn becomes blue; diluted with water, blue disappears. BB borax, slowly dissolved, yielding iron glass, which, when treated in R. F. and flamed gives grayish-white bead. For further reactions see Dana's System. *A.* In granite. With Iolite, Magnetite, Wolframite, and Cassiterite.
Hex. (?) *H.* crystalline. *S.* in small frag. grs. and crystal. masv., intersp.	*Cl.* perfect in one direction. *Fr.* scaly.	$H_4Ni_2Si_3O_{10}$	G. ± 2.525. In thin lamellæ, translucent; optically uniaxial, negative, with strong double refraction. *A.* Röttisite, which is thought to be a variety.
Hex. (rhbdrl.) *H.* hex. prism. *S.* gran. masv.	*Cl.* I imperfect	$(Fe,Al)_2(SO_4)_3\cdot(H_2O)_9$	G. 2.092. Taste astringent, soluble in cold water. If solution be heated Fe_2O_3 is precipitated. Soluble in dilute HCl. *A.* Forms bed in felspathic or trachytic rock.
Orthrhm. *H.* acic. *S.* semi-crystalline masses.	.....	$PbCl_2$	G. ± 5.25. Soluble in 22 parts of hot water. BB fuses readily, spreading and volatilizing, on inner edge coating yellow; coating disappears in reduction flame, giving azure-blue color. With soda, button of lead. Added to Ph. salt, bead previously saturated with CuO gives reaction for Cl. *A.* Sodium and Copper Chlorides and Cop. Sulphate. Also massive with other lead minerals. In lava of Vesuvius.

NAME.	COLOR.	STREAK.	LUSTRE.	HARD'SS.	TENACITY.
Crocidolite (Krokydolith) (Blaueisenstein) (Riebeckite(?))	lavender-blue to leek-green	lavender-blue to leek-green	silky to dull	4	tough, compact, and elastic
Danburite	pale wine-yellow to colorless, yellowish white to yellowish brown	white	vitreous, brilliant	7.25	brittle
Dickinsonite	olive to oil or grass green	light gray	vitreous to pearly	3.5	brittle
Dumortierite	bright smalt blue to greenish blue	.....	vitreous	7	.....
Durangite	light and dark orange red	cream-yellow	vitreous	5	brittle

TAL SYSTEM, ABIT, AND RUCTURE.	CLEAVAGE AND FRACTURE.	CHEMICAL FORMULA.	REMARKS. Sp. Gr., Reactions. *A* = Associated Minerals.
(?) rystalline, us; fibres , thin, and y sep'r'ble. sv earthy.	*Cl.* prismatic	$(Fe.Na)_2(SiO_3)_4FeSiO_3$	G. 3.25. Opaque. Fibres somewhat elastic. Pleochroism green, violet, and blue. Not affected by acids. In closed tube yields alkaline water. BB fuses easily with intumescence to a black magnetic glass, coloring the flame yellow. With fluxes reactions for Fe. *A.* Micaceous Porphyry, Gypsum, ferruginous Dolomite.
m. rismatic. n distinct edded crys- and inter- ged.	*Cl.* 0 very indistinct. *Fr.* uneven to subconchoidl.	$CaB_2(SiO_4)_2$	G. 3. Transparent to translucent. Not decomposed by HCl, but gives boric acid reaction on turmeric paper. Previously ignited gelatinizes with HCl. Phosphoresces on heating, giving reddish light. BB fuses at 3.5 to colorless glass, coloring flame green in O. F. (Boron.) *A.* Microcline and Oligoclase in Dolomite, Pyroxene, Titanite, Tourmaline, Mica, Quartz, Pyrite, also Chlorite.
abular, do-rhmbd. rdinarily . to micac., ed, lam'lar, or stellatd.	*Cl.* 0 perfect. *Fr.* uneven.	$(Mn,Ca,Fe,Na_2)_{12}(PO_4)_8.(H_2O)_3$	G. 3.34. Slightly dichroic, soluble in acids. Closed tube, water first neutral then slightly acid, residue magnetic. Fuses in lamp flame. BB forceps flame, first green then greenish yellow. With fluxes reacts for Fe and Mn. *A.* Eosphorite, Triploidite, Lithiophyllite.
rhm. rarely in als. sually in mnar aggates.	*Cl.* i–ī distinct.	$Al_2(AlO)_6(SiO_4)_3$	G. 3.265. Transparent to translucent. Pleochroism very strong, colorless, reddish-violet, ultramarine blue. BB infusible, loses color on ignition. With cobalt solution blue; Ph. salt slightly bluish opaline bead. *A.* In fibrous forms in Feldspar of gneiss.
yr. crystls. nbedded, spersed.	*Cl.* I distinct. *Fr.* uneven.	$Na(AlF)AsO_4$	G. ± 4. Translucent. Decomposed by H_2SO_4 with evolution of HF. In matrass with soda and charcoal powder, yields sublimate of metallic arsenic. In closed tube blackens at moderate temperature, regains color on cooling. At higher heat fuses easily to a yellow glass, and gives faint white sublimate etching glass. Same in open tube evolving acid fumes. BB *ch.* fuses readily and gives white sublimate with As. odor in R. F. *A.* Cassiterite.

NAME.	COLOR.	STREAK.	LUSTRE.	HARD'SS.	TENACITY.
Dysanalyte	iron-black	.....	submetallic	5.5	.....
Endlichite (perhaps variety of Vanadinite)	ruby red, light brownish or straw-yellow, reddish brown	white to yellowish	fracture surface resinous	3	brittle
Eosphorite (Childrenite)	rose-pink, yellowish to colorless: compact forms grayish, bluish, yellowish white	white or light gray	vitreous	5	brittle
Euclase	colorless, pale mountain green passing into blue and white	uncolored	vitreous, pearly on cl. face	7.5	brittle
Eudialyte	rose, bluish, brownish red, chestnut-brown	uncolored	vitreous	5.25	brittle

CRYSTAL SYSTEM, HABIT, AND STRUCTURE.	CLEAVAGE AND FRACTURE.	CHEMICAL FORMULA.	REMARKS. Sp. Gr., Reactions. *A* = Associated Minerals.
Isometric. *H.* holocrystl'd. *S.* embedded.	*Cl.* cubic	$Na_2(Ca,Fe)_8$. $Ce(NbO_3)_3Ti_{10}O_{29}$	G. 4.13. *A.* In granular limestone.
Hexagonal. *H.* pyramidal, hemihedral. *S.* in rounded forms and parallel groupings, implanted glob. and incrust'ns.	*Fr.* fibrous	$Pb_5[(As,V)O_4]_3Cl$	G. ± 7. Decomposed by HCl. Fused with $KHSO_4$ three parts, forms a clear yellow mass which reddens on cooling. If HNO_3 be dropped upon the crystals they become deep red from separation of V_2O_5, then yellow on its solution. In closed tube decrepitates, yielding a faint white sublimate. BB fuses easily, *ch.* to a black, lustrous mass, which in R. F. yields metallic lead and coating of $PbCl_2$. After complete oxidation in O.F., gives green bead with Ph. salt in R. F., becoming light yellow in O.F. *A.* Calamine, Pyromorphite.
Orthrhm. *H.* prismatic. *S.* generally massive, cleavable to close compact.	*Cl.* i–ī perfect. *Fr.* uneven to subconchoidl.	$(Mn,Fe)H_2O_2$. $(OH)_3AlPO_4$	G. ± 3.13. Often impure from admixture of Quartz, Dickinsonite, and Apatite. Detrepitates in closed tube, whitens, and evolves water. Residue turns black, gray, and finally liver brown, becomes magnetic and assumes metallic lustre. BB plat. forceps cracks, sprouts, and whitens; colors flame pale green; fuses at 4 to black magnetic mass; strong Mn reaction. *A.* Rhodocrosite, Lithiophyllite, Triploidite, Dickinsonite in Pegmatite.
Mcl. *H.* prismatic. *S.* always in crystals.	*Cl.* i–ì highly perfect. *Fr.* conchoidl.	$(AlOH)BeSiO_4$	G. 3.1. Transparent or subtranspar'nt. Pleochroism distinct. Not acted on by acids. In closed tube strongly ignited gives off water. BB forceps, cracks, whitens, throws out points, and fuses 5.5 to white enamel. *A.* Topaz, Corundum, Cyanite, Pericline, Rutile, Quartz on mica schist.
Hexagonal. (rhmbdrl.) *H.* Tabular rhmbdrl.; also prismatic. *S.* massive in embedded grs., sometimes reniform.	*Cl.* 0 perfect. *Fr.* subconchoidal, splintery.	$(Na,K,H)_{12}(Ca,Fe)(Zr,Si)_{20}O_{52}$	G. ± 2.92. Translucent to subtransluc'nt. Gelatinizes with HCl and dilute solution turns turmeric deep brown, even after the Fe has been reduced to colorless protochloride by boiling with metallic tin (Zr). BB fuses to light green opaque glass, coloring the flame yellow. With fluxes reactions for Fe and Mn. *A.* Arfvedsonite, Sodalite. Embedded in latter or in white Feldspar.

NAME.	COLOR.	STREAK.	LUSTRE.	HARD'SS.	TENACITY.
Fergusonite (Tyrite)	brownish black; in thin scales pale liver-brown	pale brown	externally dull; fresh fr. brilliant, vitreous, sub-metal.	5.75	brittle
Fibroferrite	honey, ochre-yellow	ochre-yellow	pearly, silky	3.25	.....
Frenzelite	bluish gray	gray, shining	metallic	3	somewhat sectile
Gadolinite	black, greenish black, brown	greenish gray	vitreous to greasy	6.75	brittle

TAL SYSTEM, ABIT, AND RUCTUR	CLEAVAGE AND FRACTURE.	CHEMICAL FORMULA.	REMARKS. Sp. Gr., Reactions. *A* = Associated Minerals.
ag. nihdrl.) yram. or natic. ispersed, minated, ive.	*Cl.* traces. *Fr.* subconchoidal.	$Y(Nb,Ta)O_4$	G. 5.838. Subtranslucent to opaque. In closed tube gives a little water. Evaporated with H_2SO_4, yields white residue, which with metal. zinc and HCl gives bluish-green color. BB infusible. *Ch.* becomes pale yellow. With borax dissolves slowly, giving hot yellow bead, the insoluble part white, saturated bead yellowish red, made opaque by flaming. Slowly dissolved by Ph. salt, leaving white insoluble residue, in O. F. yellow, in R. F. colorless. Treated with tin, bead uncolored, insol. res. flesh-red. Decomposed by soda without dissolving, leaving reddish slag. With soda *ch.* globules of metallic tin. *A.* Zircon, Cyrtolite, Thorogummite, Magnetite.
(?) elicately us aggres.	.....	$Fe_6(OH)_8(SiO_4)_5(H_2O)_{23}$	G. 1.84. Translucent. Soluble in water, and decomposed by boiling water. Closed tube yields water, and at higher temperature H_2SO_4. BB *ch.* becomes magnetic, and with soda gives reaction for H_2SO_4. With fluxes iron reaction *A.* Coquimbite.
rhm. cic. prism. longit'dly. asv. with . foliation.	*Cl.* i–ī distnct.	$Bi_2(Se,S)_3$	G. ± 6.4. Decomposed by aqua regia on slow heating. BB *ch.* fuses with a blue flame, giving strong odor of Se. With KI red coating of BiI_3. *A.* Native Bi and Pyrite.
rismatic, lly termid by **0**, but etimes by e pyramid. oarse crys; also in ses.	*Cl.* none. *Fr.* conchoidl or splintery.	$Fe[Be(Y.O)SiO_4]_2$	Nearly transparent in thin splinters, and usually grass to olive green. Gelatinizes with HCl after being heated to phosphorescence. The glassy isotropic variety unchanged in closed tube, but if heated BB emits bright light, swells, cracks, appears grayish green without fusing, and becomes anisotropic. The normal anisotropic variety swells into cauliflower ramifications and becomes white. With borax gives Fe. reaction. *A.* Allanite in Pegmatite and granite, Yttrialite Nivenite. Fergusonite, Cyrtolite, Gummite, Fluorite, Molybdenite, Magnetite, Feldspar, Quartz, and Mica.

NAME.	COLOR.	STREAK.	LUSTRE.	HARD'SS.	TENACITY.
Gahnite (Zinkspinell)	dark grayish, leek-green, greenish, bluish black, yellowish, grayish brown	grayish	vitreous, somewhat greasy	7.75	brittle
Gay Lussite (Gaylüssit) (Natrocalcit)	white, yellowish white	uncolored to grayish	vitreous	2.5	very britt
Gibbsite	white, grayish, greenish or reddish white, reddish yellow when impure	white or light gray	O pearly; other surf'c's vitreous	3	tough
Glaucodot (Kobaltarsenkies, Danaite)	grayish tin-white	black	metallic	5	brittle
Glauconite	olive, blackish, yellowish, grayish green	.....	dull or glistening	2	friable
Gmelinite	colorless, yellowish, greenish, reddish white	colorless	vitreous	4.5	brittle

TAL SYSTEM, ABIT, AND TRUCTURE.	CLEAVAGE AND FRACTURE.	CHEMICAL FORMULA.	REMARKS. Sp. Gr., Reactions. *A* = Associated Minerals.
ıetric. Octahedral, n with ıted planes.	*Cl.* octahedral distinct. *Fr.* conchoidl to uneven.	$Zn[(Fe,Al)O_2]_2$ or $(Zn,Fe)(AlO_2)_2$	G. 4.3. Subtransparent to nearly opaque. BB gives coating of ZnO when treated *ch.* with borax and soda. For other reactions, see Spinel. *A.* Beryl, Phenacite, Tourmaline, Garnet, Apatite, Fibrolite in granite.
redge-shpd. gated. ispersed dissemi- d.	*Cl.* I perfect. *Fr.* conchoidl.	$(Na_2.Ca)(CO_3)_2.(H_2O)_5$	G. 1.94. Translucent. Dissolves in acids with effervescence. Partly soluble in water and reddens turmeric. Heated in closed tube, decrepitates and becomes opaque. BB fuses easily to white enamel and colors the flame yellow. *A.* Trona, etc.
ıb. and hex. ım. radiate sphdl. con- ons, stalac- mamillary, incrust'ns.	*Cl.* 0 eminent.	$Al.PO_4.(H_2O)_4$	G. ± 2.35. Translucent crystals, sometimes transparent. Strong argillaceous odor when breathed on. Soluble in concentrated H_2SO_4. In closed tube becomes white and opaque and yields water. BB infusible, whitens. With cobalt solution gives a deep blue color. *A.* Magnetite in schist. Cavities in Natrolite, Corundum.
ırhm. rismatic. ıassive.	*Cl.* 0 rather perfect. *Fr.* uneven.	$(Fe,Co)As.S$ or $(Fe,Co)(As.S)_2$	G. ± 5.95. Opaque, closed tube slight subl. As_2O_3. In the open tube sulphurous fumes and subl. As_2O_3. BB *ch.* R. F. gives As and S, fusing to feebly magnetic button, black on surface but on frac. light bronze color and metallic lustre. *A.* Cobaltite in Chlorite slate, Chalcopyrite and Pyrite.
rphous. ran. masv. avities nbling ıy chlorite.	.....	Hydrous silicate of Fe and K.	G. ± 2.3. Some varieties entirely decomposed by HCl, others not attacked. Yields water. BB fuses to a dark magnetic glass. A mixture of minerals. *A.* Abundant in green-sand of the chalk formation.
. (rhmdrl.) ımbdrl. as- hexagonl. crysts. em- ed and in- ersed.	*Cl.* I distinct. *Fr.* uneven.	$(Na_2Ca)Al_2Si_4O_{12}.(H_2O)_6$	G. ± 2.1. Transparent to translucent. Decomposed by HCl with separation of SiO_2. BB fuses easily to a white enamel. *A.* In amygdaloidal rocks in argillaceous schist with Analcite and Heulandite.

NAME.	COLOR.	STREAK.	LUSTRE.	HARD'SS.	TENACITY.
Guitermanite	bluish gray	gray	metallic	3	.....
Hanksite	white	colorless	vitreous	3.25	brittle
Hatchettolite (perhaps decomposed Uranium Pyrochlore)	yellowish brown	pale	resinous	5	brittle
Herderite	yellowish or greenish white	.....	vitreous to sub-resinous	5	.....
Hisingerite	black	yellowish brown	greasy to vitreous	3	.....
Hyalophane	colorless, flesh-red	.....	vitreous	6.25	brittle
Hydrotalcite (Völknerite)	white	.....	pearly	2	soft, somewhat flexib

ıL SYSTEM, IT, AND UCTURE.	CLEAVAGE AND FRACTURE.	CHEMICAL FORMULA.	REMARKS. Sp. Gr., Reactions. *A* = Associated Minerals.
ssive, ıct.	.....	$(PbS)_{10}.(As_2S_3)_3$	G. 5.94. Opaque. *A.* Zunyite.
ʒonal. ɔrt prism. ular. erpene- ʒ groups.	*Cl.* **O** distinct. *Fr.* uneven to subconchoidl.	$(Na_2)_5CO_3(SO_4)_4$	G. 2.562. Taste, saline; transparent to translucent. Soluble in water. Effervesces with acids. BB fuses easily, giving yellow flame. *A.* Halite, Thenardite, Glauberite, Trona, Borax.
tric. ahedral. bedded.	*Fr.* subconchoidal	Uranium Tantalo-niobate containing Ti, W, Sn, Ca, Y, Fe, K, Na, and H_2O	G. ± 4.8. Translucent, decomposed by concentrated H_2SO_4. BB infusible, but turns yellow and colors flame reddish-yellow; glows when ignited. With borax and soda light green bead. Colorless on cooling. *A.* Samarskite.
ım. rt prism., ɣramidal.	*Cl.* I interrupted. *Fr.* subconchoidal.	$Ca[Be(OH,F)]PO_4$	G. ± 3. Translucent. Dissolves in acids. In closed tube evolves acid water when strongly heated. BB phosphoresces, with orange light. With cobalt solution blue. *A.* Quartz, Muscovite, Albite, Tourmaline.
ɔhous.	*Fr.* conchoidl	Hydrated ferric silicate	G. ± 2.75. Probably a mixture. Decomposed without gelatinizing by HCl. In closed tube yields much water. BB fuses with difficulty to black magnetic slag, gives iron reaction with fluxes. *A.* Pyrite.
ɔrt prism. ɜsive.	*Cl.* **O** perfect. *Fr.* conchoidl.	$KBaAl_3Si_5O_{16}$	G. ± 2.8. Transparent to translucent. Not acted on by acids. BB fuses with difficulty to a bleb-by glass. *A.* Barite, Tourmaline, Mica, Realgar, Dufrenoysite, Sphalerite, in granular Dolomite, manganif. Epidote in limestone, massive Feldspar.
ʒonal. ıellar ʿe, foli- nd some- ibrous.	*Cl.* **O** eminent. I distinct.	$Al(OH)_3(Mg(OH)_2)_3(H_2O)_3$	G. ± 2.07. Greasy to the touch. In closed tube yields much water. BB infusible, but exfoliates somewhat and glows. With Co solu. pale rose-red. With fluxes intumesces and gives clear, colorless glass. *A.* In Schist and on Serpentine.

NAME.	COLOR.	STREAK.	LUSTRE.	HARD'SS.	TENACITY
Hydrozincite (Zinkblüthe)	white, grayish, or yellowish	lustrous	dull	2.25	.....
Jacobsite	black	blackish brown	metallic brilliant	6	.....
Jefferisite	dark brownish yellow; light yellow by transmitted light	light	pearly on cl.	1.5	flexible
Jordanite	lead-gray	black	metallic	3	brittle
Långbanite	iron-black	dark reddish brown	metallic, brilliant	6.5	brittle
Langite	blue to greenish blue	.....	vitreous or silky	2.75	.....
Laurionite	colorless	.....	adamant. silky	3.25	.....

TAL SYSTEM, ABIT, AND RUCTURE.	CLEAVAGE AND FRACTURE.	CHEMICAL FORMULA.	REMARKS. Sp. Gr., Reactions. *A* = Associated Minerals.
sv., earthy, y, fibrous, ct, as in- sometimes like agate	*Fr.* uneven	$(Zn.OH)_2Zn(OH)_2CO_3$	G. ± 3.7. In closed tube yields water. For other reactions, see SMITHSONITE. *A.* Calamine, Smithsonite, Sphalerite.
etric. istorted edrons. an. in rol'd les, embed.	.....	$[(Fe,Mn)O_2]_2Mn$	G. 4.75. Magnetic. Soluble in HCl with slight evolution of Cl. BB infusible. Does not lose weight when ignited. With fluxes reacts for Fe and Mn. *A.* White Mica and native Copper in crystalline limestone, Tephroite, Calcite.
(?) oad cryst. s, surface anes often ed triang.	*Cl.* basal eminent	$(Al,Fe)_4Mg_4H_{12}Si_5O_{26}$	G. 2.3. Decomposed by HCl. When heated to 300°, exfoliates. BB in forceps, after exfoliation, becomes pearly white and opaque and fuses to dark gray mass. With fluxes reactions for SiO_2 and Fe. *A.* In Serpentine.
rhm. ins mak'g hex. shps, m. or tab. crust'ns.	*Cl.* i–ĭ distnct. *Fr.* conchoidl.	$Pb_4As_2S_7$	G. 6.39. Opaque. BB. See SARTORITE and DUFRENOYSITE. *A.* Dufrenoysite, Sartorite, Binnite, Sphalerite.
gonal. x., prism., inent and cally stri-	*Cl.* none. *Fr.* conchoidl.	$(Mn,Fe)_{22}Sb_2Si_4O_{35}$	G. ± 4.92. Opaque. Soluble in HCl with difficulty, without evolution of Cl. BB infusible, but becomes dull on surface. *Ch.* gives faint white subl. With Ph. salt, a silica skeleton. Fused with salt and saltpetre, a deep green mass. *A.* Schefferite in gran. crystal limestone. Also, Richterite, Braunite, Magnetite, Hausmannite.
rhm. ins, small, lane I. bro-lamel- oncretion- rusts.	*Cl.* 0 and i–ĭ	$(Cu.OH)_2.(Cu(OH)_2)_2SO_4.H_2O$	G. ± 3.49. Translucent. BB *ch.* yields water, acid fumes, and metallic copper. Passes, when heated, through bright green, olive-green, and black. Final acid reaction. *A.* Connelite, in argilla. schist.
rhm. inute pris. als with ery striæ.	*Cl.* i–ĭ distinct	PbOHCl	G. —— Transparent. Soluble partly in hot water in powder, completely in HNO_3. Closed tube, water is expelled. BB fuses easily to a yellowish, opaque bead. *Ch.* with soda, a lead button. *A.* Phosgenite, Cerussite.

NAME.	COLOR.	STREAK.	LUSTRE.	HARD'SS.	TENACIT
Lead	gray	gray	metallic	1.5	malleabl and duc
Levynite (Levyn)	colorless grayish, greenish, reddish, yellowish	colorless	vitreous	4.25	brittle
Lithiophorite	bluish black	blackish gray	dull to metallic	3	.....
Lithiophilite (Triphylite)	light clove-brown, often very dark on surface	uncolored to grayish	vitreous to resinous	4.75	.....
Ludwigite	blackish green to slightly violet black	dark	silky on fresh fracture	5	easily cu
Manganostibiite (Hematostibiite)	black	brownish	.....	.....	.....

TAL SYSTEM, ABIT, AND RUCTURE.	CLEAVAGE AND FRACTURE.	CHEMICAL FORMULA.	REMARKS. Sp. Gr., Reactions. *A* = Associated Minerals.
ıetric. vins, octdl., ɔdecahedl. sually thin ɜs, glob. ıes, dendrit.	.....	Pb	G. 11.37. Dissolves easily in dilute HNO_3. Fuses at 330°C. BB fuses easily, giving yellow coating, which volatilizes in R. F., giving azure-blue tips to flame. *A.* In thin scales in Hematite, Magnetite, Hausmannite; crystals with Caryopilite, Sarkinite, Brandtite.
agonal. hombhrl, tration s, uneven rounded. ys. often in es lin. cav. :clusion of r minerals.	*Fr.* subconchoidal.	$CaAl_2Si_3O_{10}\cdot(H_2O)_5$	G. ± 2.12. Transparent to translucent, double refraction strong. Gelatinizes with HCl and HNO_3. BB intumesces and fuses to a white blebby glass nearly opaque. *A.* In Amygdaloid and Basalt.
.....	.....	Hydrated Manganese oxide containing Li and Al	G. ± 3.2. See PSILOMELANE. *A.* Quartz.
rhm. ystals rare with coarse uneven ı. asv., cleavto comp'ct.	*Cl.* 0 perfect. *Fr.* uneven to subconchoidl.	$Li(Mn,Fe)PO_4$	G. ± 3.5. Transparent to translucent. Soluble in HCl. In closed tube decrepitates and gives traces of water. BB fuses at 1.5. In platina wire loop when moistened with H_2SO_4, colors flame red in streaks, with pale bluish green on exterior of cone of flame. With fluxes reaction for Fe and Mn. *A.* Spodumene, Cymatolite, Eosphorite, Triploidite, Rhodocrosite, Uraninite in albitic granite.
rhm. ı finely us masses.	*Fr.* tough	$Mg_2O.FeO_2BO_2$	G. ± 4. Strongly pleochroic. Dissolved in powder slowly by HCl. BB heated in air becomes red. In fine splinters fusible with difficulty to a magnetic slag. With fluxes gives reactions for iron. *A.* Magnetite in crystalline limestone.
nbedded ıs, compact	.....	$Mn_2(Mn_8O_7)(Sb,As)O_4$ The formula of Hematostibiite is $(Mn,Fe)_2(Mn,Fe)_8O_7(SbO_4)_2$	G. —— Opaque. Dissolves completely in HCl. With HNO_3 gives a clouded solution. BB does not fuse but *ch.* gives Sb coating. With soda reacts for Mn. *A.* Hausmannite, Pyrochroite, Allactite.

NAME.	COLOR.	STREAK.	LUSTRE.	HARD'SS.	TENACITY
Matlockite	clear yellowish, sometimes slightly greenish	.....	adamant. sometimes pearly	2.75	.....
Meionite (Mejonit)	colorless to white	.....	vitreous	5.75	brittle
Melanophlogite	light brown or colorless	.....	vitreous	6.75	.....
Mesolite (Mesolith)	white, colorless, grayish, yellowish	.....	vitreous or silky	5	brittle, l tough wl cryptocr talline
Metacinnabarite	grayish black	black	metallic	3	brittle
Microcline	white to pale cream-yellow, red, and green	.....	vitreous, pearly	6.25	brittle

TAL SYSTEM, ABIT, AND RUCTURE.	CLEAVAGE AND FRACTURE.	CHEMICAL FORMULA.	REMARKS. Sp. Gr., Reactions. *A* = Associated Minerals.
agonal. abular.	*Cl.* 0 imperfect. *Fr.* uneven, slightly conchoidal.	Pb_2OCl_2	G. 7.21. Transparent to translucent. Soluble in HNO_3. In closed tube decrepitates and becomes more yellow. BB *ch.* fuses easily and is reduced to metallic lead, with evolution of acid vapors, giving white coating with inner edge of yellow. Ph. salt bead saturated with As colors flame azure blue. *A.* Phosgenite.
agonal. hort prism. rystal. and sive.	*Cl.* i–i perf. I less so. *Fr.* conchoidl.	$Ca_4Al_2(AlO)(AlO_8Si_2)_3$	G. ± 2.72. Decomposed by acid without gelatinizing. BB fuses with intumescence to a white blebby glass at 3. *A.* In limestone blocks, green Mica, Sanidine, Magnetite, Titanite, Augite, Apatite.
ido-isomet. inute cubes sphr. aggre. st isotropic, rior aggr. rization. crustation.	.....	Hydrated silico-sulphate of iron with some carbon	G. ± 2.03. BB fuses black superficially when heated. Carbon exists in yellowish grains of unknown composition. Heated on platinum foil they blacken and disappear. *A.* Calcite, Celestite implanted on incrustations of opaline Silica over the sulphur crystals of Girgenti.
m and Mcl. prismatic. lasv. stalc., elain-like.	.....	$\begin{cases} Na_2Al(AlO)(SiO_3)_3 \cdot (H_2O)_2 \\ CaAl[Al(OH)_2](SiO_3)_3 \cdot (H_2O)_2 \end{cases}$	G. ± 2.3. Dimorphic. Transparent to translucent. Opaque when amorphous. Gelatinizes with HCl. In closed tube yields water. BB becomes opaque, swells up, fusing to blebby enamel. *A.* Chabazite, Calcite, Thomsenite, Gismondite, Phillipsite, Faroelite.
metric. etrdl., faces gh. lasv., amor.	*Fr.* subconchoid. to uneven	Hg S	G. 7.81. Opaque. BB. See CINNABAR. *A.* Quartz, Marcasite.
prism. and tabul. like oc., fi. gratstria., near- t rt. angles. lasv., cleav. ran. comp't.	*Cl.* basal perfect, i-i less so. *Fr.* uneven.	$(K,Na)Al\,Si_3O_8$	G. ± 2.55. Transparent to translucent. BB. See ORTHOCLASE. *A.* See ORTHOCLASE.

NAME.	COLOR.	STREAK.	LUSTRE.	HARD'SS.	TENACITY.
Microlite	pale yellow to brown, rarely hyacinth-red	pale yellowish or brownish	resinous	5.5	brittle
Mixite	emerald to bluish or pale green	like color but paler	.....	3.5	.....
Monazite	hyac.-red, clove-brown, reddish and yellowish brown	.....	resinous	5.25	brittle
Monticellite	colorless, yellowish gray, pale greenish gray, whitish	uncolored	vitreous, resinous	5.25	brittle
Neotocite (Neotokit) (Wittingit)	black to dark or liver brown	dark brown to black	dull to feebly submetallic	3.5	.....

'AL SYSTEM, BIT, AND IUCTURE.	CLEAVAGE AND FRACTURE.	CHEMICAL FORMULA.	REMARKS. Sp. Gr., Reactions. *A* = Associated Minerals.
etric. ɔtahedral. ıall, ıdded als.	*Fr.* conchoidl.	Mainly $Ca_2Ta_2O_7$ but Ca is partly substituted by Mn, Fe, and Mg; Ta by Nb; and some alkalies and F and water are always present	G. ± 5.5. Transparent or translucent to nearly opaque. Not attacked by HCl, but slowly decomposed by H_2SO_4. Decomposed on fusion with $KHSO_4$ and solution of fused mass uncolored when boiled with metallic Sn. BB infusible. In Ph. salt slowly soluble, giving O. F. bead, yellow hot, colorless on cooling. R. F. after long time pale bluish-green bead. *A.* Albite, Tourmaline, Spodumene, Columbite, Cassiterite, Monazite, Spessartite, Beryl, Fluorite, smoky Quartz.
or Trcl. cicular. ıcrustation ·eg. partls., . rough or rical renif.	.....	$BiCu_{10}(OH)_8(AsO_4)_5 \cdot (H_2O)_7$	G. 3.79. Transluc. to transp. in fine fibres. In dilute HNO_3, covered with layer of white powder of Bi arsenate, insoluble in the acid. BB on ignition becomes dark green and gives water. *Ch.* white button of BiCu with coating of Bi oxide. *A.* Bismuth ochre, Bismutite, Torbernite, Barite, Erythrite.
mall flatd prism., iform. ıassive anr fragmts., d grains.	*Cl.* 0 sometimes perfect	(Ce,La,Di)PO_4	G. ± 5. Subtransp. to subtranslucent. With difficulty soluble in HCl. BB infusible. Turns gray, and, moistened with H_2SO_4, colors flame bluish green. With borax bead yellow while hot, colorless on cooling. Saturated bead becomes enamel-white on flaming. *A.* Red Feldspar, Zircon, Gadolinite, Sillimanite, Tourmaline, Microlite, Rutile, Hiddenite.
ırhm. nded crys. mbedded talline ns and vable masv.	*Cl.* i–ĭ distinct. *Fr.* subconchoidal to uneven.	Ca(Mg,Fe)SiO_4	G. ± 3.15. Transparent to translucent. Soluble in HCl to clear solution, which gelatinizes on evaporation. BB rounded only on the edges. *A.* Mica, Augite, Calcite, black Spinel.
ɔrphous	.....	Hydrated Mn silicate	G. 2.75. Opaque. Closed tube yields much water. BB fusible with difficulty to infusible. Reactions with borax for Mn and Fe. *A.* Rhodonite. Perhaps product of decomposition of this mineral.

NAME.	COLOR.	STREAK.	LUSTRE.	HARD'SS.	TENACITY
Nesquehonite	colorless to white	.....	vitreous or greasy	2.5	brittle
Onofrite	blackish gray	blackish gray	metallic	2.5	brittle
Pachnolite (Pyrosonite)	colorless to white	.....	vitreous	3	brittle
Parisite	brownish yellow	yellowish white	vitreous	4.5	brittle
Pectolite (Pektolith)	whitish or grayish	.....	silky or sub-vitreous	5	brittle
Periclase	colorless to grayish and dark green	.....	.....	6	.....

TAL SYSTEM, ABIT, AND RUCTURE.	CLEAVAGE AND FRACTURE.	CHEMICAL FORMULA.	REMARKS. Sp. Gr., Reactions. *A* = Associated Minerals.
rhm. rismatic. d'g groups, ctitic in- tations.	*Cl.* I perfect, 0 less so. *Fr.* splintery.	$MgCO_3.(H_2O)_3$	G. 1.83. Transparent to translucent. BB reactions for Mg, CO_2, and water. *A.* Lansfordite.
etric. etrahedral, ihedral. ne granu- massive.	*Cl.* none. *Fr.* conchoidl.	$Hg(Se,S)$	G. ± 8.05. Opaque. In closed tube decrepitates and gives reaction for S and Hg, coating tube dark gray and leaving slight residue. In open tube SO_2 and sublimates of Hg and HgSeS. *Ch.* fumes with Se odor and subl. with metal. lustre, which disappears R. F., coloring the flame blue. Faint Zn and Mn reactions. *A.* Calcite, Barite, Tiemannite.
rismatic, rm. appear-, acutely inated.	*Cl.* 0 indistinct. *Fr.* uneven.	$Na,Ca,F_3.AlF_3.H_2O$	G. ± 2.97. Transparent to subtransparent. BB. See THOMSENOLITE and CRYOLITE. *A.* Cryolite, Thomsenolite.
agonal. cute, le trun- l pyram.	*Cl.* 0 very perfect. *Fr.* small conchoidal.	$Ce(CeF)(CaF)(CO_3)_3$	G. ± 4.36. Transparent in thin sections. Dissolves slowly in HCl with effervescence. In closed tube gives CO_2 and becomes lighter in color. BB glows. Infusible. With fused Ph. salt in open tube, reaction for F. With borax and Ph. salt in plat. loop gives bead, yellow while hot, colorless cooling. *A.* In emerald mines.
l elongtd., , acic. als. brs. masv., l. to stellat.	*Cl.* 0 perfect i–ī perfect. *Fr.* uneven.	$Na_2Ca_3(SiO_3)_3$	G. ± 2.73. Subtransl. to opaque. Often emits light when broken. Decomposed by HCl with separation of SiO_2. In closed tube yields water. BB fuses at 2 to white enamel. *A.* Chlorite, Calcite, in cavities and seams of basic eruptive rocks. In Elæolite-syenite.
etric. ubic or edral. grns. dis- l. in clust.	*Cl.* cubic, perfect; octahedral, less distinct	MgO	G. 3.674. Transp. to transluc. Pulverized shows alkaline reaction and dissolves in mineral acids without effervescence. BB infusible and unaltered. The Mn variety becomes dark. With Co solu., flesh-red after long heating. *A.* Forsterite. Magnesite, in dolomitic limestone with Hausmannite and Brucite, the latter as alteration product.

NAME.	COLOR.	STREAK.	LUSTRE.	HARD'SS.	TENACITY.
Petalite	colorless, white, gray, reddish, or greenish white	uncolored	vitreous, pearly	6.25	brittle
Petzite (Tellurgold-silber) (Hessit)	steel or iron gray to black	.....	metallic	2.75	slightly sectile to brittle
Phenacite (Phenakit)	colorless, bright wine-yellow, pale rose-red, brown	.....	vitreous	7.75	brittle
Piedmontite (Piemontite) (Manganepidot)	reddish brown, reddish black, in thin splinters columbine red	reddish	vitreous, pearly	6.5	fragile
Plumboferrite	black	red	.....	5	.....

CRYSTAL SYSTEM, HABIT, AND STRUCTURE.	CLEAVAGE AND FRACTURE.	CHEMICAL FORMULA.	REMARKS. Sp. Gr., Reactions. *A* = Associated Minerals.
Mcl. *H.* tabular. *S.* masv., foliated, cleavable.	*Cl.* **0** perfect. *Fr.* imperfectly conchoidal.	$(Li,Na,H)Al(Si_2O_5)_2$	G. ± 2.43. Transp. to translucent. Blue phosphorescence on gentle heating. Not affected by acids. BB *ch.* becomes glassy, subtransp. and white, and melts only on edges. Gives Li reaction. With borax clear, colorless glass. *A.* Lepidolite, Tourmaline, Spodumene, Quartz, Scapolite, in Albite, Tremolite.
Orthrhm. (?) *S.* masv., fine granular to compact.	*Fr.* subconchoidal	$(Ag,Au)_2Te$	G. ± 9. BB see HESSITE. The button contains both Au and Ag. *A.* Native Gold.
Hexagonal. *H.* rdrl. tetartohdrl., lenticular, prismatic. *S.* sometimes embedded.	*Cl.* i–2 distinct. *Fr.* conchoidl.	Be_2SiO_4	G. ± 3. Transparent to subtransluc. BB unaltered. With borax fuses very slowly to transparent glass. With a little soda white enamel, with more intumesces and becomes infusible. With Co solution dull blue. *A.* Emerald, Chrysoberyl, Topaz, green Feldspar, Quartz, Limonite, Hematite, Adularia, Amazonstone, Beryl, Mica.
Mcl. *H.* prismatic. *S.* massive.	*Cl.* **0** perfect, i–ī less so.	$Ca_2(AlOH)(Mn,Al)_2(SiO_4)_3$	G. ± 3.4. Opaque to subtranslucent. Not decomposed by acids, but when ignited gelatinizes with HCl. Decomposed on fusion with alkaline carbonates. BB fuses with intumescence (3) to black glass. With fluxes gives reactions for Mn and Fe. *A.* Braunite, Quartz, Greenovite, Violan, Tremolite in Glaucophane schist and Chlorite Cericite of Archean. Epidote, Mica.
S. massive, cleavable.	.....	$Pb(Fe_2O_2)_3$	G. —— Feebly magnetic. Dissolves readily in HCl with evolution of Cl and formation of $PbCl_2$. *A.* Jacobsite in granular limestone.

NAME.	COLOR.	STREAK.	LUSTRE.	HARD'SS.	TENACITY.
Polyarsenite See SARKINITE					
Polycrase	black, brownish in splinters	grayish brown	vitreous to resinous	5.5	brittle
Polymignite (Polymignyt)	black	dark brown	submetallic, brilliant	6.5	.....
Prosopite	colorless, white, grayish	.....	vitreous, feeble	4.5	brittle
Pyrrharsenite (Pyrrhoarsenit) See BERZELIITE					
Quenstedtite	reddish violet	.....	vitreous	2.5	.....
Ralstonite	colorless to milky; often yellow on surface	.....	vitreous	4.5	brittle

CRYSTAL SYSTEM, HABIT, AND STRUCTURE.	CLEAVAGE AND FRACTURE.	CHEMICAL FORMULA.	REMARKS. Sp. Gr., Reactions. *A* = Associated Minerals.
Orthrhm. *H.* thin prism., tabular.	*Cl.* none. *Fr.* conchoidl.	$(Ca,Fe)_4Y_4UO_2Ti_{12}O_{35}\cdot[Y(NbO_3)_3]_2$	G. ± 5. Decomposed by evaporation with conc. H_2SO_4. This residue boiled in HCl with metallic Zn or Sn gives azure-blue solution which does not fade. The dilute sol. turns turmeric paper deep orange (Zr). In closed tube decrepitates and gives traces of water. BB forceps glows and turns light brown but is infusible. Soluble in borax, giving yellow bead, which with metal. tin in R. F. turns brown. *A.* Gadolinite, Orthite in granite, Zircon, Monazite, Xenotime, Magnetite.
Orthrhm. *H.* slender prismatic.	*Fr.* perfect conchoidal	$Ca_4(Ce,Fe)_4.Ca(NbO_3)_2(Ti,Zr,Th)_{10}O_{29}$	G. 4.8. Opaque. In powder heated with conc. H_2SO_4 gives whitish residue, which treated with HCl and tinfoil gives azure blue. The dilute acid solu. gives with turmeric orange color (Zr). BB infusible and unchanged in color. With borax dissolves readily, giving iron bead. With more assay brownish yellow on flaming and opaque on cooling. With tin in R. F. turns reddish yellow. *A.* Feldspar, Zircon, Elæolith, Pyrochlore, Magnetite.
Mcl. *H.* crystals, sometimes tab. *S.* gran. masv., embedded.	*Cl.* distinct in one direction. *Fr.* uneven.	$Ca(F,OH)_2[Al(F,OH)_3]_2$	G. 2.88. Transpar. to translucent. Decomposed by H_2SO_4. In glass tube gives water (expelled above 260° C.) and SiF_4. *A.* Fluorite, Pachnolite, Astrophyllite.
Mcl. *H.* tabular and elongated.	*Cl.* i–ī perfect. *Fr.* fibrous.	$Fe_2(SO_4)_3\cdot(H_2O)_{10}$	G. 2.116. Transparent. Readily soluble in water. *A.* Coquimbite.
Isometric. *H.* octahedral.	*Cl.* none. *Fr.* uneven.	$(Na_2Mg)F_2\cdot[Al(F,OH)_3]_3\cdot(H_2O)_2$	G. ± 2.6. Transpar. to translucent. Decomposed by H_2SO_4, evolving HF. In closed tube whitens, gives acid water, and subl., which etches the tube. BB infusible. *Ch.* faint white subl. In forceps whitens and colors flame yellow. *A.* Cryolite, Thomsenolite.

NAME.	COLOR.	STREAK.	LUSTRE.	HARD'SS.	TENACITY.
Römerite	light brown to yellow	.....	vitreous	3.25	brittle
Roscoelite (Roscoelith)	brown to greenish	.....	pearly	.....	soft
Roselite (Roselith)	light to dark rose-red	.....	vitreous	3.5	.....
Samarskite (Yttroïlmenit)	velvet-black	dark reddish brown	vitreous to resinous	5.5	brittle
Sarkinite (Polyarsenite)	rose, flesh-red, reddish yellow	light rose-red	greasy	4.5	.....
Schirmerite	lead-gray to iron-black	.....	metallic	.....	brittle

AL SYSTEM, BIT, AND UCTURE.	CLEAVAGE AND FRACTURE.	CHEMICAL FORMULA.	REMARKS. Sp. Gr., Reactions. *A* = Associated Minerals.
b. mcl. arsely and crys- e.	*Cl.* i–ī perfect. *Fr.* uneven.	$Fe_2(Fe,Zn)(SO_4)_4(H_2O)_{12}$	G. 2.174. Transpar. to translucent. Pleochroic. Taste, saline astringent. Soluble in water, giving acid sol. Basic salts separate on heating. *A.* Copiapite and other iron sulphates.
ıall scales ıll. or fan- d groups. ırthy in- , micac's.	*Cl.* basal, perfect	$KH_8(Mg,Fe)(Al,V)_4(SiO_3)_{12}$	G. 2.93. Translucent. Slightly affected by acids. BB fuses easily to a black glass. Gives, with Ph. salt, a dark yellow bead O. F., and an emerald-green bead R. F. *A.* Quartz, Calaverite.
nall com- ;wins. ·uses and . aggrgts.	*Cl.* i–ī. *Fr.* ——	$(Ca,Co,Mg)_3(AsO_4)_2.(H_2O)_2$	G. ± 3.55. Transp. to translu. Dissolves in acids. Heated to 100° becomes dark blue and splits, but becomes red again on cooling. BB fuses easily. *Ch.* gives As. fumes. After roasting, reacts for Co with fluxes. *A.* Quartz.
·hm. ismatic, ;imes tab. dinarily ve, in flat- embed- rains.	*Cl.* i–ī imperfect. *Fr.* conchoidl.	$[(Fe,Y,Ce,Er)_4(Nb_2O_7)_3]_8(Fe,Y,Ce,Er)U_5O_{21}$	G. ± 5.7. Nearly opaque. Sol. of powder boiled in concent. H_2SO_4 gives blue with metallic Zn or Sn. In closed tube glows, cracks, turns black, and loses density. BB fuses to black glass on edges. Borax O. F., yellowish green to red bead. R.F. greenish black, which becomes opaque when flamed, and yellowish brown. Ph. salt in both flames emerald-green bead. *A.* Aeschenite, Columbite in reddish-brown feldspar.
ismatic to ar. ouped in ic'l forms.	*Cl.* prismatoid distinct-	$Mn(Mn.OH)AsO_4$	G. ± 4.18. Easily soluble in HCl. BB decrepitates and fuses with some difficulty to black non-magnetic bead. *Ch.* with soda, brownish mass and arsenical odor. Closed tube gives water, becomes brown, and residue reacts with fluxes for Mn. *A.* Iron-manganese minerals.
·hm. (?) assive, granular. ;persed.	*Cl.* none. *Fr.* uneven, soft, brittle.	$(Ag_2Pb)_3Bi_4S_9$	G. ± 6.74. BB fuses easily, evolving SO_2 and giving reactions for Bi, Pb, and Ag. *A.* With Te minerals.

NAME.	COLOR.	STREAK.	LUSTRE.	HARD'SS.	TENACITY
Schorlomite	black, sometimes tarnished blue	grayish black	vitreous	7.25	. .....
Scolecite (Mesotyp)	white, light or ochre yellow, light or brick red	light gray	vitreous, silky	5.25	.....
Seybertite (Bronzite) (Clintonite)	reddish brown, yellowish, copper-red	uncolored	pearly, submetallic	4.5	brittle
Sideronatrite (Urusit)	orange to straw-yellow	pale yellow	.....	2.25	.....
Sperrylite	tin-white	black	metallic	6.5	brittle
Stilpnomelane (Chalcodite) (Cronstedtite(?))	black, greenish black and bronze, greenish bronze	.....	pearly, vitreous, submetallic, brass-like	3.4	somewhat brittle
Struvite (Guanite)	yellowish to brown, white	.....	vitreous	2	brittle

TAL SYSTEM, ABIT, AND 'RUCTURE.	CLEAVAGE AND FRACTURE.	CHEMICAL FORMULA.	REMARKS. Sp. Gr., Reactions. *A* = Associated Minerals.
ıetric. rapdrl and ɔcahedral. ıasv. with- cleavage, ılly.	*Cl.* none. *Fr.* conchoidl.	$(Ca,Fe,Mg)_3(Fe,Ti)_2[(Si,Ti)O_4]_3$	G. ± 3.85. Gelatinizes with HCl, the sol. becoming violet when boiled with metal. tin (Ti). BB fuses (3) to black glass. With fluxes reactions for Fe. Fused with tin in Ph. salt on *ch.* R. F. violet bead. *A.* Elæolite, Brookite, Garnet.
lndr. prism. ivrg. grps., v., fibrous, , in nod'l's.	*Cl.* I nearly perfect. *Fr.* massive, earthy, radial.	$CaAl[Al(OH)_2](SiO_3)_3(H_2O)_2$	G. ± 2.3. Transp. to subtransluc. Pyroelectric. Gelatinizes with acids. BB curls up like a worm, and fuses about 2 to a white blebby enamel. *A.* In cavities of amygdaloid, trap, granite, and basalt.
tab., some- ɜ hex. form. ılli'td, mica's	*Cl.* 0 perfect. *Fr.* coarse gran., fine gran., fibrous.	$H_6(Mg,Ca,Fe)_{10}.Al_{10}Si_4O_{36}$	G. ± 3. In powder, acted on by conc. acids. Yields water. BB infusible, but whitens. *A.* Serpentine, Amphibole, Spinel, Pyroxene, Graphite, Chlorite.
(?) ı crystalline ses, fi'ly fib.	*Cl.* in one direction	$Na_3(Fe.OH)_2(SO_4)_3$	G. ± 2.25. Soluble in acids. Insoluble in cold water, but decomposed on boiling with separation of Fe_2O_3. *A.* Melanterite.
ıetric. ɔubic. ne grains, ersed.	*Fr.* conchoidl.	$(Pt,Rh)(As,Sb)_2$	G. ± 10.6. Opaque. BB decrepitates slightly. Closed tube unchanged. Open tube subl. of As_2O_3. Does not melt if roasted slowly, but heated rapidly melts easily. Dropped on red hot plat. foil, melts, giving white fumes, and porous excrescences are formed of same color as untouched foil. *A.* Pyrite, Chalcopyrite, Cassiterite.
(?) ɔolia. plates ı. or radia. ɔbrous coat- or tufted.	*Cl.* in one plane	$[(Fe,Mg)O]_2.(Fe,Al)_2O_3.(SiO_2)_5.(H_2O)_3$	G. ± 2.85. Dissolves in HCl. In closed tube yields much water. BB fuses to black metallic button giving reactions for iron. *A.* Calcite, Quartz, Pyrite, Magnetite.
ırhm. ɔrismatic, imorphic, flattened. ıterspersed, lanted.	*Cl.* 0 perfect, i–ĭ less so. *Fr.* conchoidl to uneven.	$Mg(NH_4)PO_4.(H_2O)_6$	G. ± 1.68. Transluc. to opaque. Tasteless. Pyroelectric. Soluble in acids. In closed tube gives H_2O and NH_3, and becomes opaque. BB colors flame green and fuses to an enamel which gives purple with Co solution. *A.* In guano, under manure piles.

NAME.	COLOR.	STREAK.	LUSTRE.	HARD'SS.	TENACITY
Sussexite	pinkish or yellowish white	.....	silky to pearly	3	.....
Tellurite	white to honey-yellow	.....	sub-adamant.	2	flexible
Tenorite	steel-gray to dull earthy	steel-gray, black	metallic	3.5	earthy
Thenardite	white to brownish	.....	vitreous	2.5	brittle
Thermonatrite	white to yellowish	.....	vitreous	1.25	sectile
Thomsenolite	colorless to reddish white or white	.....	vitreous	2	brittle
Thorite (Orangit)	orange, brownish yellow, or black	light orange to dark brown	vitreous, resinous, greasy	4.75	brittle

TAL SYSTEM, ABIT, AND RUCTURE.	CLEAVAGE AND FRACTURE.	CHEMICAL FORMULA.	REMARKS. Sp. Gr., Reactions. *A* = Associated Minerals.
ırhm. (?) rystalline. ı fibrous ıs or veins.	.....	$(Mn,Mg,Zn)OHBO_2$	G. 3.42. Translucent. Soluble in HCl. Closed tube yields water. If turmeric paper is moistened with this water and then with dilute HCl, it becomes red (B). Forceps melts in candle flame. BB O. F. yields a black crystalline mass coloring flame yellowish green. With fluxes reacts for Mn. *A.* Franklinite, Zincite, Willemite, and other Mn and Zn minerals.
ırhm. lndr., pris- c, tabular. ıfted, sphl. ıted.	*Cl.* i–ĭ	TeO_2	G. 5.9. Transp. to transluc. In open tube when strongly heated fuses to brown drops and sublimes. *A.* Native Te.
or trcl. (?) ıin, shining ːs. arthy, mas- pulvernt.	*Cl.* easy in one direction. *Fr.* conchoidl to uneven.	CuO	G. 5.82. Soiling the fingers. Soluble in HCl and HNO_3. BB O. F. infusible. For other reactions see CUPRITE. *A.* In lava. Decomp. product of Chalcopyrite, etc.
ırhm. ːyrm., short m., or tab. npltd., incr.	*Cl.* 0 distinct. *Fr.* uneven.	Na_2SO_4	G. 2.68. Transp. to transl. Soluble in water. Tastes. BB colors flame deep yellow. *A.* On volcanic scoria. Deposited by evaporation of saline water, Hanksite, Glauberite, Ulexite.
ırhm. ːab., prism. sually efflr.	*Cl.* i–ĭ difficult. *Fr.* ——	$Na_2CO_3.H_2O$	G. ± 1.55. Taste alkaline. Soluble in water. Effervesces with acids. BB deep yellow flame. *A.* Efflorescence of Natron.
ːubic, pris- ic, pyram. nassive.	*Cl.* 0 perfect I less so	$NaCaF_3.AlF_3.H_2O$	G. ± 2.97. Transp. to transl. Dimetric. Powder decomposed by H_2SO_4. Fuses more easily than Cryolite. Decrepitates in candle flame. See CRYOLITE. *A.* With Pachnolite or Cryolite as alteration product of latter.
ːagonal. hort, pyrm. ɔed prisms. nassive and pact.	*Cl.* I distinct. *Fr.* conchoidl.	$ThSiO_4$	G. ± 5.3. Transp. in thin splinters to nearly opaque. After calcination gelatinizes with HCl. Closed tube yields water. BB *cA.* infusible, edges only glazed. With borax yellowish bead, colorless on cooling. Ph. salt, colorless glass, milky greenish on cooling. Borax an orange glass when hot, grayish on cooling unless nitre be added, when the orange color remains. *A.* In Augite-syenite, with Alvite, Magnetite.

NAME.	COLOR.	STREAK.	LUSTRE.	HARD'SS.	TENACITY.
Tridymite (Asmanit)	colorless to white	.....	vitreous, 0 pearly	7	brittle
Turgite (Turjit) (Hydrohämatit)	reddish black to dark and bright red	red	submetallic, satin-like, dull, earthy	5.5	.....
Tysonite	pale yellow fresh, changing to yel. and red. brown	.....	vitreous to resinous, pearly	4.75	brittle
Vanadinite (Endlichite)	ruby-red, light brownish or straw-yellow, reddish brown	white to yellowish	fr. surf. resinous	3	brittle
Variscite (Callait)	deep emerald-green to colorless	light gray	vitreous, brilliant	5	.....
Warwickite (Enceladite)	dark hair-brown to black	bluish black	submetallic, pearly to subvitreous	3.5	brittle

TAL SYSTEM, ABIT, AND RUCTURE.	CLEAVAGE AND FRACTURE.	CHEMICAL FORMULA.	REMARKS. Sp. Gr., Reactions. *A* = Associated Minerals.
ırhm. ınute, thin ılar. lso fan- ɔed and ɜrcl. radial.	*Cl.* I indistinct. *Fr.* conchoidl.	SiO_2	G. ± 2.3. Transparent. Reactions, see QUARTZ. *A.* In acidic, less so in basic, volcanic rocks. Sanidine, Hornblende, Augite, Hematite, Opal, Quartz, Feldspar, Fayalite.
ompact, fi- ıs, divergt., ydl., stalac. hy	. .....	$Fe_4O_5(OH)_2$	G. ± 4.4. Opaque. Closely related to limonite. Heated in closed tube flies to pieces, yields water. Otherwise see HEMATITE. *A.* Limonite, on which it often forms an outer layer.
:agonal. ıhick ms, tabular. ıasv., clvbl.	*Cl.* 0 perfect. *Fr.* subconchoidal.	$(Ce,La,Di)F_3$	G. ± 6.13. Transp. to transluc. Insoluble in HCl and HNO_3, but soluble in H_2SO_4 with evolution of HF. BB blackens but does not fuse. Closed tube decrepitates, changes to light pink. *A.* Quartz, Albite, Pyrophysalite, Allanite.
:agonal. ɔyr., hmhdl. ll prism. cic. ıded forms, ıllel group- , implanted incrust'ns.	*Fr.* fibrous, fine stalky	$Pb_5Cl(VO_4)_3$	G. ± 7. Reactions (without As) and *A.* See ENDLICHITE.
ırhm. ɔrismatic. heaf-like reg'ns, with form sur- s.	*Cl.* —— *Fr.* compact.	$AlPO_4.(H_2O)_2$	G. —— Transparent to translucent. In matrass yields water. BB forceps infusible but whitens, coloring outer flame deep bluish-green. With borax and Ph. salt, forms pale yellowish-green glass. With soda fuses imperfectly with effervescence. With Co solution deep blue. *A.* Quartz and siliceous slate.
hrhm. ılon. prisms, ı rounded ınations. mbedded.	*Cl.* i–ī. *Fr.* uneven.	$Mg_6(Fe,Al,B)_6Ti_2O_{19}$	G. 3.35. Pleochroic. Decomposed by H_2SO_4. The residue treated with alcohol and ignited gives green flame, and boiled with HCl and metallic tin a violet color (Ti). Closed tube yields water. BB infusible but loses density. Moistened with H_2SO_4 gives green flame. Ph. salt, O. F. clear bead, yellow hot and colorless on cooling. R. F. *ch.* with tin violet color (Ti). *A.* Spinel, Chondrodite, Serpentine.

NAME.	COLOR.	STREAK.	LUSTRE.	HARD'SS.	TENACITY.
Xanthosiderite (Gelbeisenstein)	needles gold yellow; brown to brownish red	ochre-yellow	silky, greasy, pitchy, earthy	2.5 needl's	.....
Xenotime (Ytterspath)	yellowish, reddish, hair-brown, yellow	pale brown, yellowish, reddish	resinous to vitreous	4.5	brittle
Yttrocerite	violet blue inclining to gray and white	.....	shining vitreous to pearly	4.5	.....
Yttrotantalite (Fergusonit in part)	black, brown, brownish yellow	gray to colorless	submetallic, vitreous, greasy	5.25	.....
Zinnwaldite (In part Lithion-glimmer)	pale violet, yellow to brown and dark gray	pale gray	pearly	2.75	laminæ tough and flexible
Zunyite	colorless	colorless	vitreous	7	.....

CRYSTAL SYSTEM, HABIT, AND STRUCTURE.	CLEAVAGE AND FRACTURE.	CHEMICAL FORMULA.	REMARKS. Sp. Gr., Reactions. *A* = Associated Minerals.
(?) *H.* fine acic., stellate, concen. *S.* ocher.	.....	$Fe_2O.(OH)_4$	G. —— Reactions, see LIMONITE. *A.* Limonite, Psilomelane.
Tetragonal. *H.* pyram. or short prismatic, with pyr. term. *S.* disseminated rolled grains.	*Cl.* I perfect. *Fr.* uneven and splintery.	$(Y,Ce)PO_4$	G. 4.45. Opaque. Insoluble in acids. BB infusible. Moistened with H_2SO_4 colors flame bluish green. Soluble with difficulty in Ph. salt. *A.* Polycrase, Malacon, Orthite, Zircon, Rutile, Tysonite.
(?) *S.* massive, crystalline, granular, and earthy	*Cl.* in two directions, inclined to each other 71° 30′. *Fr.* uneven.	$(Y,Er,Ce)F_3.(CaF)_5.H_2O$	G. ± 3.45. Pulverized, dissolves completely in HCl, giving a yellow solution. Closed tube gives water. BB *ch.* infusible. *A.* Quartz, Albite, Topaz.
Orthrhm. *H.* prismatic, also tabular. *S.* embedded, dispersed.	*Cl.* i–ĭ indistinct. *Fr.* small conchoidal.	$Y(Nb,Ta)O_4$ besides Ca, Fe tantalate, and some U, W, Er, Ce, and Sn	G. ± 5.7. Opaque to subtransl. Not decomposed by acids. In the closed tube yields water and turns yellow. Intense ignition becomes white. BB infusible. Ph. salt dissolves with a separation of a skeleton of tant. oxide, which is afterward dissolved by strong heat, leaving glass faintly rose (W). *A.* Pegmatite, Quartz, Albite, Garnet, Mica, Pyrophysalite.
Mcl. *H.* tabular, lamellar, pseudo-hexagonal. *S.* massive fan-shaped; in rosettes.	*Cl.* basal, perfect. *Fr.* scaly-gran.	$(Li,K,Na)_3Al_3Fe Si_5O_{16}(F,OH)_2$	G. ± 3. Successive layers of different colors. Pleochroism distinct in some kinds. Melts in candle flame with red color. Reactions as in Lepidolite, except that it is more fusible and reacts for iron. *A.* Tourmaline granite in tin mine of Zinnwald.
Isometric. *H.* hemihedral, tetrahedral. *S.* embedded, dissem. grains.	*Cl.* positive and negative tetrahedral. *Fr.* ——	$Al_2[Al(OH,F,Cl)_2]_3 (SiO_4)_3$	G. 2.875. Clear and transparent. Not attacked by acids. Closed tube yields acid water. BB infusible, but becomes opaque. *A.* Sulphides of As and Pb, Guitermanite, Pyrite.

TABLE OF ELEMENTS.—(1896.)

[The atomic weights are calculated on the basis of O = 16.]

NAME.	Symbol.	Atomic Weight.	Apparent Valence.	Number of Atoms in the Molecule.	State.*	Discoverer.	Date.
Aluminum	Al	27.	III	Two	Solid	Woehler	1828
Antimony	Sb	120.	III, v	"	"	Valentine	1460
†Argon	A	40.	(?)	(?)	Gas	Rayleigh and Ramsay	1895
Arsenic	As	75.	III, v	Four	Solid	Schroeder	1694
Barium	Ba	137.	II	Two	"	Davy	1808
Beryllium (or *Glucinum*)	Be or G	9.	II	"	"	Woehler	1828
Bismuth	Bi	208.9	III, v	"	"	Agricola	1529
Boron	B	11.	III	"	"	Davy	1807
Bromine	Br	79.95	I, iii, v, vii	"	Liquid	Balard	1826
Cadmium	Cd	112.	II	One	Solid	Stromeyer	1817
Caesium	Cs	132.9	I, iii (?)	Two	"	Bunsen	1860
Calcium	Ca	40.	II	"	"	Davy	1808
Carbon	C	12.	IV	"	"	Ancients	.....
Cerium	Ce	140.2	II, iv, iii (?)	"	"	Berz. and Hisinger	1808
Chlorine	Cl	35.45	I, iii, v, vii	"	Gas	Scheele	1774
Chromium	Cr	52.1	II, iv, iii	"	Solid	Vauquelin	1797
Cobalt	Co	59.	II, iv, iii	"	"	Brandt	1733
Copper	Cu	63.6	II, i (?)	"	"	Ancients	.....
‡Didymium?	D	142.3	II	"	"	Mosander	1841
Erbium	Er	166.	III	"	"	Mosander	1843
Fluorine	F	19.	I	"	Gas	Moissan	1886
Gallium	Ga	69.9 §	III	"	Solid	de Boisbaudran	1875
Germanium	Ge	72.3	IV	"	"	Winkler	1886
Gold	Au	197.3	III	"	"	Ancients	.....
†Helium	He	4.26	(?)	(?)	Gas	Ramsay	1895
Holmium	Ho (?)	162.	III	Two	Solid	Cleve	1879
Hydrogen	H	1. ‖	I	"	Gas	Cavendish	1766
Indium	In	113.7	III	"	Solid	Reich and Richter	1863
Iodine	I	126.85	I, iii, v, vii	"	"	Courtois	1812
Iridium	Ir	193.1	ii, IV, iii (?)	"	"	Tennant	1804
Iron	Fe	56.	II, iv, iii	"	"	Ancients	.....
Lanthanum	La	138.2	II.	"	"	Mosander	1839
Lead	Pb	206.95	II, iv	"	"	Ancients	.....
Lithium	Li	7.02	I	"	"	Davy	1818
Magnesium	Mg	24.3	II	"	"	Davy	1808

* At ordinary temperatures.
† Never certainly isolated.
‡ Probably mixture of Neodidymium (Nd) 140.8, and Praseodidymium (Pr) 143.6.
§ W. Ostwald, in Dr. Rudolf Biedermann's "Chemiker-Kalender, 1897."
‖ Accurately 1.007 if O = 16.

NAME.	Symbol.	Atomic Weight.	Apparent Valence.	Number of Atoms in the Molecule.	State.*	Discoverer.	Date.
Manganese....	Mn	55.	II, iv, iii, vii....	Two	Solid	Gahn.....	1774
Mercury.....	Hg	200.	II.....	One	Liquid	Ancients.....	.....
Molybdenum	Mo	96.	ii, iv, VI, v (?).	Two	Solid	Hjelm.....	1782
Nickel.....	Ni	58.7	II, iv.....	"	"	Cronstedt.....	1751
Niobium (or *Columbium*)	Nb or Cb	94.	V.....	"	"	Hatchett.....	1801
Nitrogen.....	N	14.03	III, v.....	"	Gas	Rutherford.....	1772
†Osmium.....	Os	191.6	ii, IV, iii, vii...	"	Solid	Tennant.....	1803
Oxygen.....	O	16.	II.....	Two or three	Gas	Priestley.....	1774
Palladium....	Pd	106.6	ii, IV.....	Two	Solid	Wollaston.....	1803
Phosphorus...	P	31.	III, v.....	Four	"	Brandt.....	1669
Platinum.....	Pt	195.	ii, IV, viii.....	Two	"	Wood.....	1741
Potassium.....	K	39.11	I, iii.....	"	"	Davy.....	1807
Rhodium.....	Ro	103.	ii, IV, iii, viii...	"	"	Wollaston.....	1803
Rubidium.....	Rb	85.5	I, iii (?).....	"	"	Bunsen.....	1860
†Ruthenium.	Ru	103.8	ii, IV, iii, vii...	"	"	Claus.....	1845
†Samarium(?)	Sm	150.	III.....	"	"	de Boisbaudran....	1888
Scandium.....	Sc	44.	III.....	"	"	Nilson.....	1879
Selenium.....	Se	79.	II, iv, vi.....	"	"	Berzelius.....	1817
Silicon.....	Si	28.4	IV.....	"	"	Berzelius.....	1823
Silver.....	Ag	107.92	I.....	"	"	Ancients.....	.....
Sodium.....	Na	23.05	I, iii (?).....	"	"	Davy.....	1807
Strontium.....	Sr	87.6	II.....	"	"	Davy.....	1808
Sulphur.....	S	32.06	II, iv, vi.....	"	"	Ancients.....	.....
Tantalum.....	Ta	182.6	V.....	"	"	Ekeberg.....	1802
Tellurium.....	Te	125.	II, iv, vi.....	"	"	Klaproth.....	1798
Terbium (?)	Tb	159.5	III.....	"	"	Mosander.....	1843
Thallium.....	Tl	204.18	I, iii.....	"	"	Crookes.....	1861
Thorium.....	Th	232.6	IV.....	"	"	Berzelius'.....	1829
Thulium(?)...	Tm	170.4	III.....	"	"	Cleve.....	1879
Tin.....	Sn	119.	ii, IV.....	"	"	Ancients.....	.....
Titanium.....	Ti	48.	IV.....	"	"	Klaproth.....	1794
Tungsten.....	W	184.	iv, VI, v.....	"	"	De Luyart.....	1786
Uranium.....	U	239.6	ii, iv, vi.....	"	"	Péligot.....	1841
Vanadium....	V	51.4	iii, $(V_2)^{iv}$, V, $(V_2)^{viii}$	"	"	Sefstroem.....	1830
Ytterbium....	Yb	173.	iv, III.....	"	"	Marignac..	1872
‡Yttrium(?)..	Y	89.1	III, iv (?).....	(?)	"	Woehler (?).....	1843
Zinc.....	Zn	65.3	II.....	Two	"	Mentioned by Paracelsus	1540
Zirconium....	Zr	90.6	IV.....	"	"	Berzelius.....	1824

* At ordinary temperatures.
† Never certainly isolated.
‡ W. Ostwald, in Dr. Rudolf Biedermann's "Chemiker-Kalender," 1897.

MOHS'S SCALE OF HARDNESS.

DEGREE.	
1	Talc.
2	Gypsum or Halite.
3	Calcite.
4	Fluorite.
5	Apatite (crystallized variety).
6	Feldspar (Adularia).
7	Quartz.
8	Topaz.
9	Corundum.
10	Diamond.

SCALES OF FUSIBILITY.

PLATTNER'S.

1. Such as fuse to a bead. (*a*) Easily. (*b*) With difficulty.
2. Such as fuse only on the edge. (*a*) Easily. (*b*) With difficulty.
3. Such as are infusible.

von KOBELL'S.*

1. *Stibnite.*—Fusible in candle flame in coarse splinters.
2. *Natrolite.*—Fusible in candle flame in fine splinters. Easily fused before the blow-pipe in coarse fragments.
3. *Almandite*, or Iron Alumina Garnet.—Infusible in candle flame, quite fusible before the blow-pipe in coarse fragments.
4. *Actinolite.*—Fusibility less than Almandite and greater than No. 5; fusible in coarse splinters.
5. *Orthoclase.*—Fusible in fine splinters.
6. *Bronzite.*—Only rounded on the edges in very fine splinters.

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* This is the only scale referred to in the preceding pages where numbers expressing fusibilities are used.

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